

## Chapter 1

### ~~SOCIAL~~ SITUATIONAL AWARENESS IN EVERYDAY SOCIAL INTERACTIONS

People participate in social interactions every day with friends, family, co-workers and strangers. A strong set of social skills is ~~critical~~ important for a successful and productive life. For our interactions are the underpinnings of our modern society and are essential for social development and acceptance of an individual within our society. Such interpersonal interactions consist of are socially driven exchanges of verbal and non-verbal communicative cues. The essence of humans, as social animals, is very well exemplified in the way humans interact face-to-face with one another. Even in a brief exchange of eye gaze, humans communicate a lot of information about themselves, while assessing a lot about others around them. Though not much is spoken, plenty is always said. We still do not understand the nature of human communication and why face-to-face interactions are so significant for us.

Social interaction refers to any form of mutual communication between two individuals (dyadic interactions) or between an individual and a group (group interactions) [2]. Such communications involve any or all forms of sensory and motor activities, as deemed necessary by the participants of the interaction. Social, Behavioral and Developmental Sociologists emphasize that the ability of individuals to effectively control expressive behavior is essential for the social and interpersonal functioning of our society. Such social interactions are the aggregate cause of social behaviors, social actions and social contact that helps not only in effective bilateral communication, but also in forming an efficient feedback loop for shaping social behavior, driven behavioral learning loop. It is this feedback (termed as social feedback) that people use towards developing social and communicative skills. Further, researchers have revealed an unconscious need in humans to mimic and imitate the mannerisms of their interaction partners. An increasing number of experiments have highlighted this need for imitation to be very primeval, and that they offer an elegant channel for building trust and confidence between individuals.

imitation plays an important role in suggested that this tendency is

It is also important to note that the results of the study were not statistically significant.

10. *Leucosia* *leucostoma* *leucostoma* *leucostoma* *leucostoma* *leucostoma* *leucostoma*

the first time in the history of the world that the people of a country have been compelled to pay for their freedom.

and the first time I have seen him in a long time, he was wearing a tattered shirt and pants.

1416年，明成祖朱棣派大将郑和下西洋，郑和率船队从刘家港出发，经占城、爪哇、苏门答腊、满剌加、暹罗、榜葛刺、天方等国，于1417年回国。

AN APPROPRIATE PRACTICE FOR THE PRACTITIONER OF THE HUMANISTIC PSYCHOLOGIES

*...and so on.*

19. *Leucosia* *leucostoma* (Fabricius) *leucostoma* (Fabricius)

It is also important to note that the results of the study were not limited to the specific context of the study, but can be applied to other contexts as well.

the first time in history that the people of the United States have been compelled to pay a tax on their property.

and the people of the world will be gathered together as one man.

其後又將其子送入太學，並為之取名，以示其子之才氣。

10. The following table gives the number of hours worked by each of the 100 workers.

10. The following table gives the number of cases of smallpox reported in each State during the year 1802.

10. अस्ति विद्युत् इव विद्युत् विद्युत् विद्युत् विद्युत् विद्युत् विद्युत्

प्राप्ति विद्युत् इव विद्युत् विद्युत् विद्युत् विद्युत् विद्युत् विद्युत्

1. *On the other hand, the author's argument is that the* *reform* *is* *not* *designed* *to* *protect* *the* *poor*.

10. The following table gives the number of cases of smallpox reported in each State during the year 1802.

Digitized by srujanika@gmail.com

Unfortunately, ~~interpersonal interactions~~ are sometimes inaccessible, like in the case of ~~remote interactions~~ where the interacting participants are ~~not able to access the other's communicative social cues~~, or in the case that one or more of the interacting individuals are ~~is visually disabled and find it hard to sense the social cues.~~

*Such as the case  
Communicating by telephone, or  
where  
to perceive non-verbal  
more difficult*

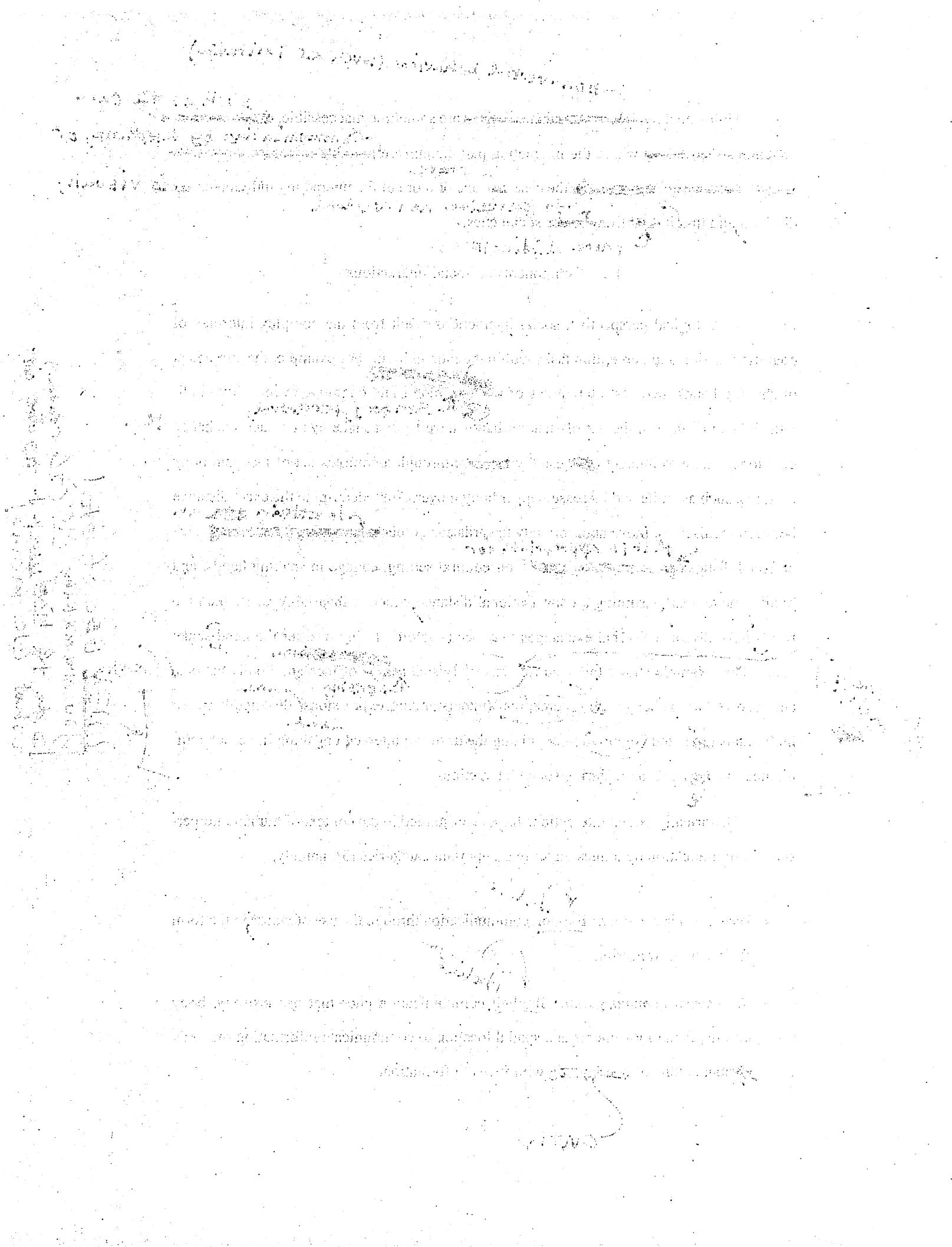
### 1.1 Components of Social Interactions

From a neurological perspective, social interactions result from the complex interplay of cognition, action and perception tasks within the human brain. For example, the simple act of shaking hands involves interactions of sensory, motor and cognitive events. Two individuals who engage in the act of shaking hands have to first make eye contact, exchange the emotional desire to interact (~~this usually happens~~ through a complex set of face and body gestures, such as smile and increased upper body movements), determine the exact distance between themselves, move appropriately towards each other ~~to attain an~~ maintaining Proxemics (interpersonal distance) ~~that is appropriate for~~ that are befitting of their cultural setting, engage in shaking hands, and finally, move apart assuming a conversational distance, which is invariably wider than the hand shake distance. Verbal exchanges may occur before, during or after the hand shake itself. This example shows the need for sensory (visual senses of face and bodily actions, auditory verbal exchange etc.), perceptual (understanding expressions, distance between individuals etc.), and cognitive (recognizing the desire to interact, engaging in verbal communication etc.) exchange during social interactions.

*Where is motor? / Sensing and / AZY use of etc! / You are asking me (I'm reading) / do the hand work to fit your out / hat etc means*

Historically, social interactions have been studied in the context of human interpersonal communication dynamics under two important categories [3], namely,

- *Verbal communication:* Explicit communication through the use of words in the form of speech or transcript.
- *Non-verbal communication:* Implicit communication cues that use prosody, body kinesis, facial movements and spatial location to communicate information that may stand alone or overlap with verbal information.



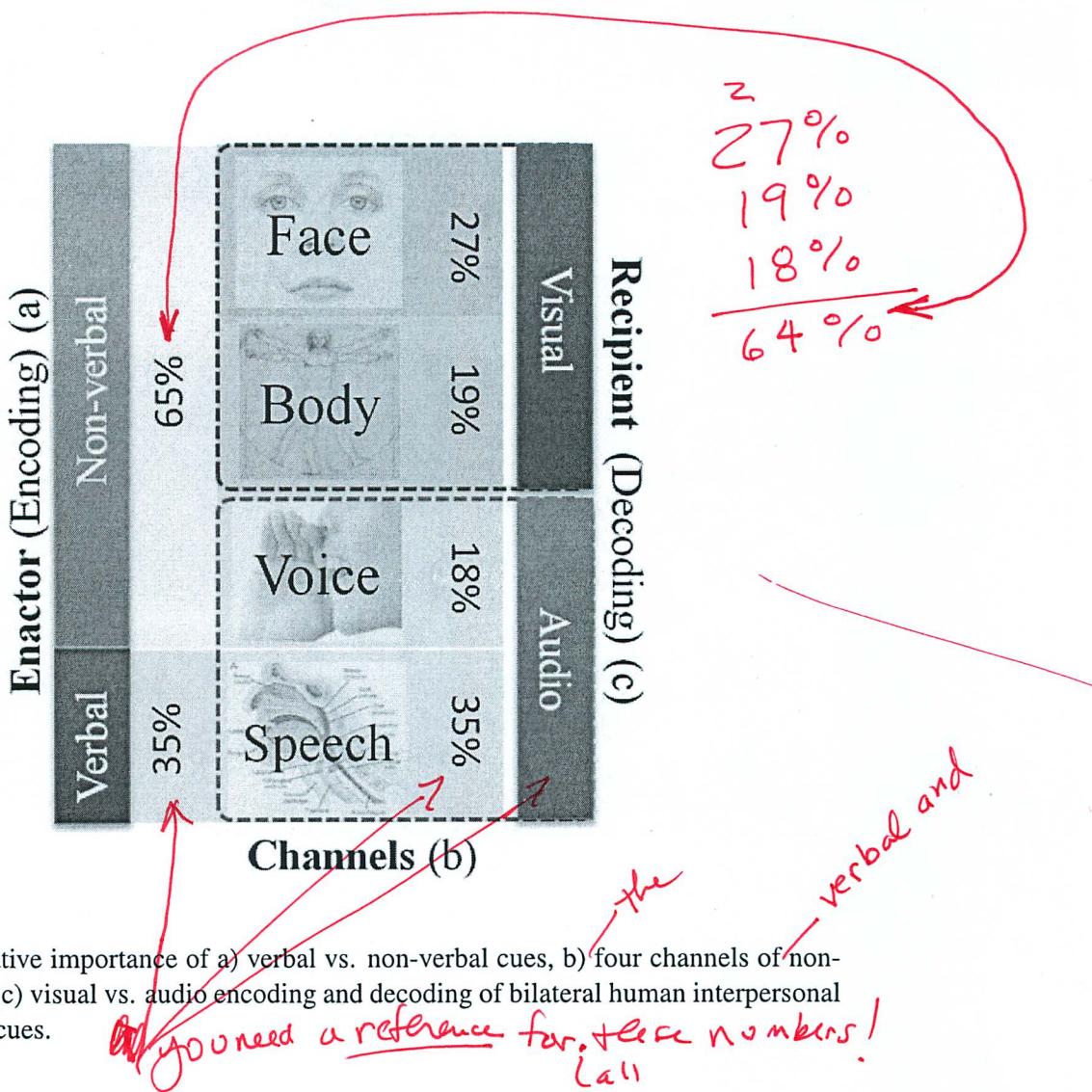


Figure 1.1: Relative importance of a) verbal vs. non-verbal cues, b) four channels of non-verbal cues, and c) visual vs. audio encoding and decoding of bilateral human interpersonal communicative cues.

### 1.1.1 Non-verbal communication cues

In everyday social interactions, people communicate so effortlessly through both verbal and non-verbal cues that they are not ~~cognizant~~ <sup>aware</sup> of the complex interplay of their voice, face and body in establishing a smooth communication channel. While the spoken language plays an important role in communication, speech accounts for only 35% of the interpersonal exchanges. Nearly 65% of all information communication happens through non-verbal cues [4]. Out of this large chunk, 48% of the communication, is through visual encoding of face and body kinesis and posture, while the rest is encoded in the prosody (intonation, pitch, pace and loudness of voice) [5]. A closer look at the various non-verbal communication modes ~~can highlight~~ <sup>reveals</sup> the importance of the multi-modality of social exchanges (See Figure 1.1).

1.1.1. A component of the non-verbal cueing ~~not represented~~ <sup>that is</sup> in the figure is the essence of ~~shown~~ <sup>is shown</sup>

*Each figure should appear AFTER it is referenced in the text*

the first time I have seen a specimen of the genus. It is a small  
shrub, 1-2 m. tall, with small leaves, opposite, entire, glabrous,  
oblong-lanceolate, 10-15 mm. long, 5-7 mm. wide, petioles 5-7 mm.  
long. Flowers numerous, white, bell-shaped, 10-12 mm. long, 5-7 mm.  
wide, in terminal cymes. Corolla lobes 5, equal, 5-7 mm. long, 2-3 mm.  
wide, spreading. Ovary smooth, style slender, 10-12 mm. long, 1 mm.  
wide, stigmas 2, linear, 2-3 mm. long. Capsule ovoid, 10-12 mm. long,  
5-7 mm. wide, smooth, pointed, 1 mm. thick. Seeds numerous, 3-4 mm.  
long, 1-2 mm. wide, smooth, brownish.

Specimen No. 10000

social touch. As will be seen later, touch is an important aspect of social interactions which ~~has~~ *that has* only recently gained attention and being studied extensively by behavioral psychologists.

#### 1.1.1.1 Social Sight and Social Hearing

Unlike speech, which is mostly under the conscious control of the user, the non-verbal communication channels are engaged from a subconscious level. Though people can increase their control on these channels through training, innately individuals demonstrate certain ~~inability~~ *the production of* ~~the~~ *are not able to completely* inability to control their non-verbal cues. This unconscious revealing of one's emotional state through non-verbal channels is referred to as ~~leakiness~~ *sensitive* [6] and observing humans ~~are able~~ *can* (evolutionarily) have learned to efficiently pick up these leaked signals during social interactions. For example, people can read very subtle body mannerisms very easily to determine ~~to sense~~ *Interpretation of eye gaze* the mental state of their interaction partner. Eye Gaze is a classic example of ~~such~~ *this* human ability to pick up subtle cues. Through the interaction partner's eyes, individuals detect interest, focus, involvement and role play, to name a few, ~~very quickly and easily~~ *can*

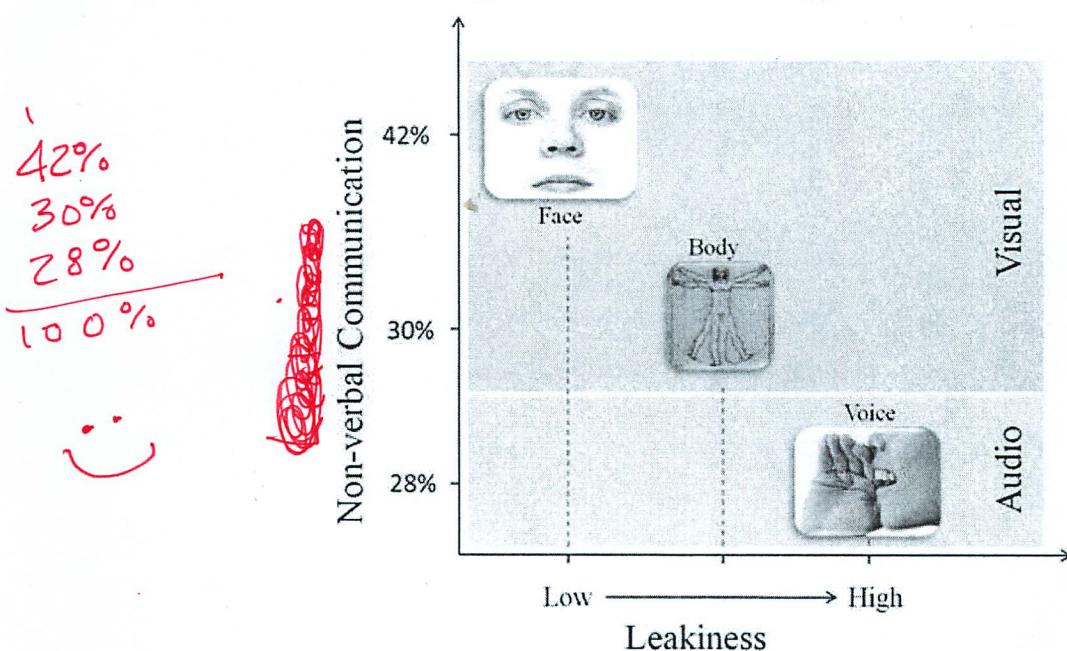


Figure 1.2: Relative communicative information plotted against its leakiness. Speech forms the verbal channel. Face, body and voice form the non-verbal communication channels.

On the leakiness scale, it has been found that the voice (not speech, mostly refers to the prosody, intonation, pitch and volume) is the leakiest of all channels, implying that the emotions of individuals are revealed first in their voice before any of the other channels are engaged. The voice is followed by body, face and finally the verbal channel, speech. The leakiness is plotted on the abscissa of Figure 1.2 with the ordinate showing the amount of information encoded in the other three non-verbal communication channels. It can be seen that the face communicates the largest portion of the total information encoded. While the prosody (voice) communicates the smallest, although it is the first channel to leak emotional information, the body being in between the other two.

*the portions of the total*

*largest portion*

*communicates the smallest, although*

*the body communicates the next largest, and*

#### 1.1.1.2 Social Touch

Apart from visual and auditory channels of social stimulation, humans increasingly rely on social touch during interpersonal interactions. For example, hand shake represents an important aspect of social communication conveying confidence, trust, dominance and other important personal and professional skills [7]. Social touch has also been studied by psychologists in the context of emotional gratification. Wetzel [8] demonstrated patron gratification effects through tipping behavior when waitresses touched their patrons. Similar studies have revealed the importance of social touch and how conscious decision making is

connected deeply with the human affect system. In the recent years social touch has gained a lot of interest in the area enriching remote interactions [9] [10] to help better understand

an individual's social awareness and social presence.

In the next section, we describe the term Social Situational Awareness through which we connect the importance of encoding and decoding of the social sight, hearing and touch information, and emphasize the need for individuals to be aware of their social situation for effective social communications.

#### 1.2 Social Situational Awareness

We refer to the term Social Situational Awareness (SSA) as the ability of individuals to receive the visual, auditory and touch-based non-verbal cues, and respond appropriately through their voice, face and/or body (touch and gestures). Figure 1.3 represents the concept

Все, что я говорю о том, что я знаю о тебе, я знаю из твоих же слов, ибо ты сам говоришь о себе.

3. The following table gives the results of the experiments made by Mr. J. C. Goss on the effect of the different methods of treatment on the growth of the larvae.

the first time, and the first time I have seen it, and I am sure it is a very good one.

卷之三

10. *Leucanthemum vulgare* L. (Lam.)

With all due respect, I believe that the best way to move forward is to let the people of the United States decide for themselves.

當初在中國，我們沒有這種的知識，所以不能作到。現在有了這種的知識，我們就可以作到。

विविध अन्तर्गत विभिन्न विषयों की विस्तृत विज्ञान और विद्या का अध्ययन करने के लिए।

10. *Yāvānīśvara* (Yāvānīśvara) is the name of a deity mentioned in the *Śāradācūḍā* (Āśvānīśvara).

10. *Leucanthemum vulgare* L. (Lam.)

10. The following is a list of the names of the members of the Board of Education.

It is a pity that all the evidence has gathered to a point where it is now impossible to

the following topics in the field of education, including the following:

Consequently, the first step in the analysis of the data is to estimate the parameters of the model.

of consuming social cues and reacting accordingly to the needs of social ~~interaction~~<sup>the situation</sup>. Social cognition bridges stimulation and reciprocation and allows individuals to interpret and react ~~appropriately~~<sup>appropriately</sup> to ~~the~~ non-verbal cues.

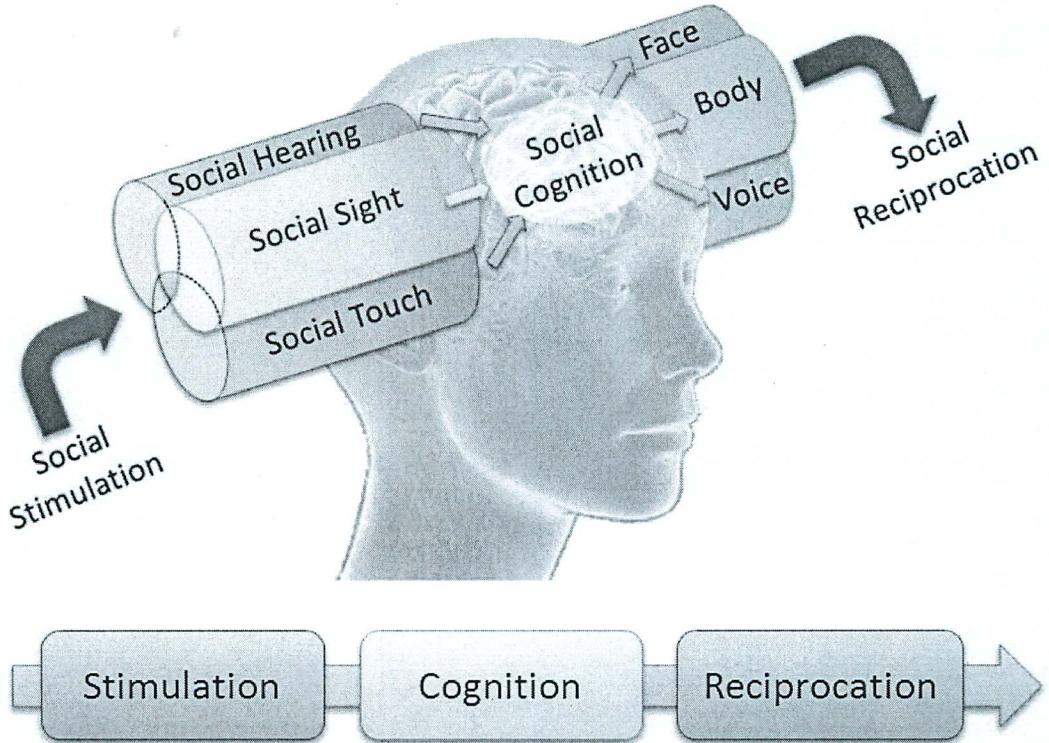
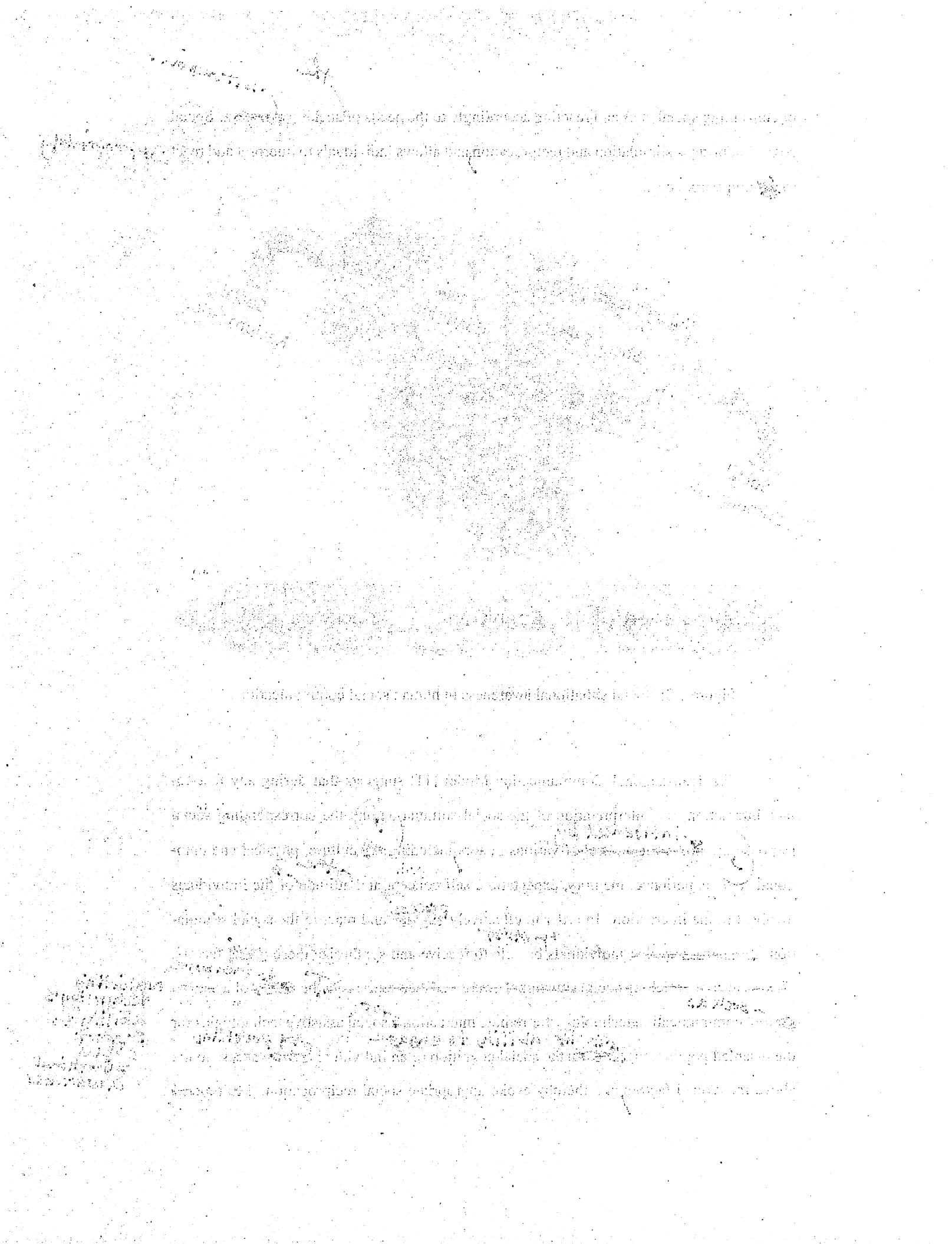


Figure 1.3: Social situational awareness in human social communications

The Transactional Communication Model [11] suggests that during any face-to-face interaction, the interpretation of the social stimulation and the corresponding social response are under the control of various factors including the culture, physical and emotional state, experience, memory, expectation, self concept and attitude of the individuals involved in the interaction. In order to effectively ~~cognize~~<sup>process</sup> and react to the social stimulation, it is necessary that individuals be able to receive and synthesize these ~~above~~<sup>all</sup> factors. The essence of enriching social situational awareness then represents the ability of a media ~~to measure~~<sup>such as</sup> or (telecommunication technology for remote interactions, social assistive technologies for the disabled population) ~~is its ability to engage~~<sup>for</sup> by providing access to the above mentioned factors and thereby evoke appropriate social reciprocation. ~~Multimedia~~<sup>mediating technology's ability to support social situational awareness</sup>



### 1.2.1 Social Situational Awareness in Everyday Social Interactions

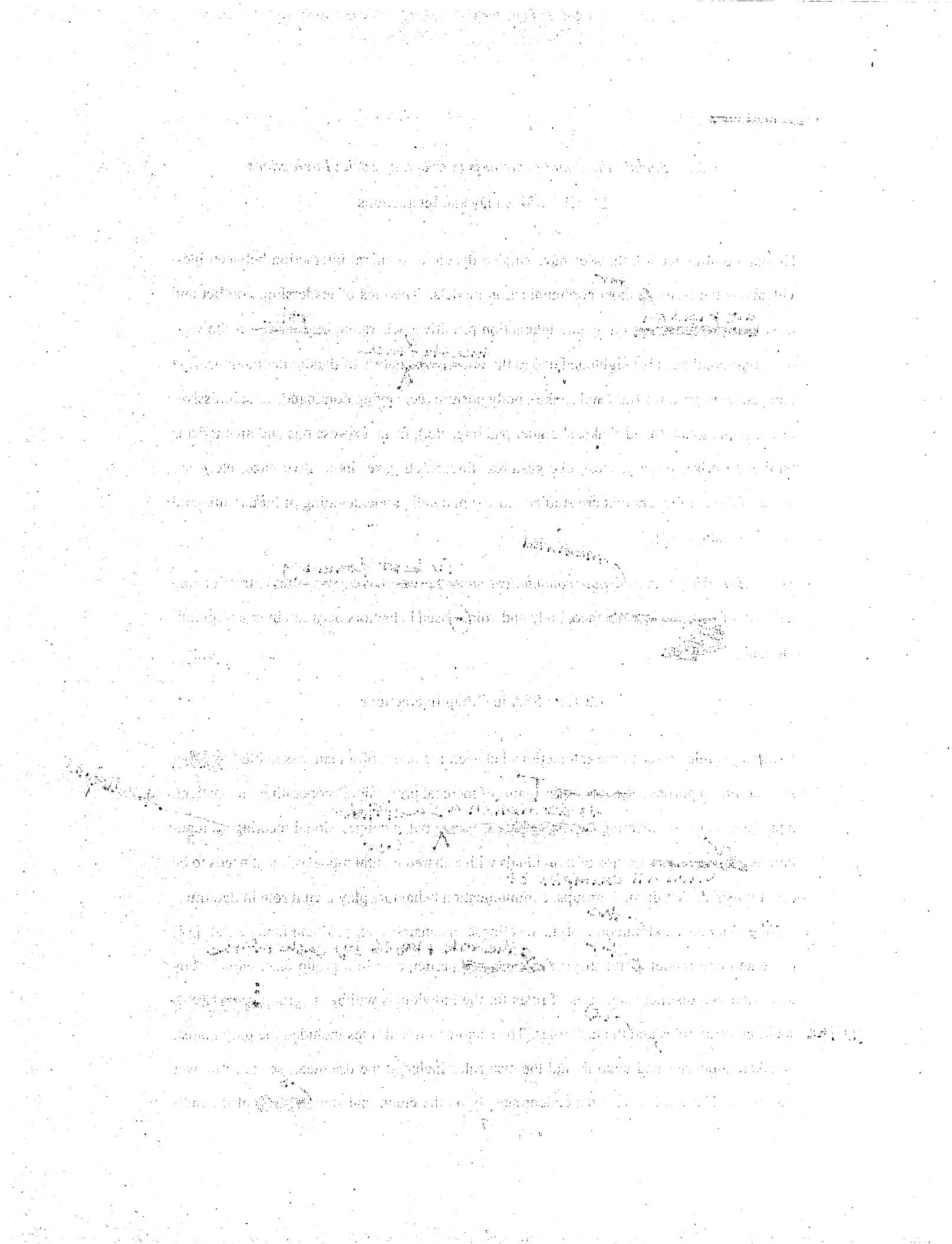
#### 1.2.1.1 SSA in Dyadic Interactions

Human communication theories have studied dyadic or bilateral interaction between individuals as the basis ~~for~~ of most communication models. Theories of leadership, conflict and trust ~~base their findings~~ on dyadic interaction primitives where the ~~importance~~ <sup>role</sup> of the various non-verbal cues is heightened due to the ~~one-on-one~~ <sup>face-to-face</sup> nature of dyadic interactions. Eye contact, head gestures (nod and shake), body posture (conveying dominance or submissiveness), social touch (hand shake, shoulder pat, hug, etc.), facial expressions and mannerisms (smile, surprise, inquiry, etc.), eye gestures (threatened gaze, inquisitive gaze, etc.) are some of the parameters that are studied closely in dyadic understanding of human bilateral communication [12].

- ☛ Enriching SSA in dyadic communication thus focuses on appropriate extraction and delivery of ~~communicator's~~ face, body and voice-based behaviors between interacting individuals.

#### 1.2.1.2 SSA in Group Interactions

Group dynamics refer to the interactions between members of a team assembled ~~together~~ for a common purpose. For example, teams of medical professionals operating on a patient, a professional team meeting ~~for achieving a certain goal~~, a congressional meeting ~~on regulations~~, etc. represent groups of individuals with a shared mental model of what needs to be accomplished. Within such groups, communication behaviors play a vital role in determining the dynamics and outcome of the meeting. Zancanaro et. al. [13] and Dong et. al. [14] presented one model of identifying ~~for the role played by each of the~~ participants in a group discussion. They identified two distinct categories of roles for the individuals within the group, namely, the (1) the socio-emotion roles, and the task roles. The socio-emotional roles included the protagonist, attacker, supporter and neutral, and the task roles included the orienteer, seeker, follower and giver. These roles were dependent heavily on the emotional state ~~(affect)~~ of the individual.



viduals participating in the group interaction. Good teams are those where individual team members and their leaders are able to compose and coordinate their affect towards a smooth and conflict free group interaction. And effective leaders are those who can read the ~~affect~~<sup>E</sup> of ~~of each~~<sup>their</sup> group member, make decisions ~~on~~<sup>about</sup> ~~each~~<sup>ranging from</sup> ~~passes~~<sup>cases</sup>, effective and successful decisions. Inability to access the affective cues of team members ~~might have~~ has significant consequences to team leaders leading to unresolved conflict situations and underproductive meetings, or in the worst case, the death of a patient.

- ⊕ Enriching SSA in ~~group interactions thus correspond to the extraction and delivery of~~<sup>is best done by</sup> team's interaction dynamics (~~which are in turn modulated in the group's mutual and group affect~~<sup>as well as</sup> ~~other~~<sup>to</sup> the participating members of the team (a remotely located team member or to a co-located individual who is disabled).

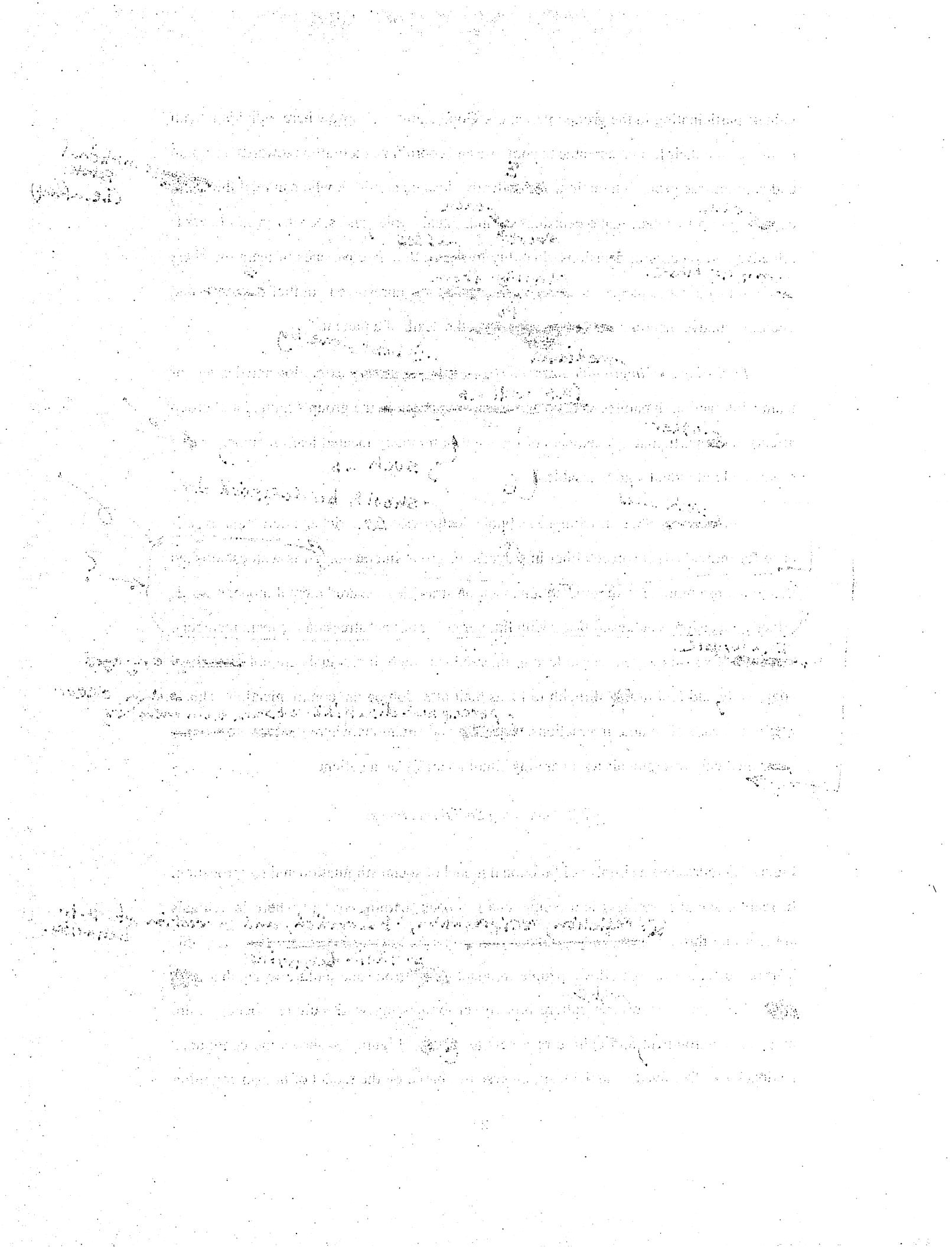
In ~~essence~~<sup>Such cases</sup>, SSA enrichment technologies provide for a richer interaction experience for individuals involved either in a dyadic or group interaction. It is well established that in teams comprising of good communication strategies a shared mental model towards effective decision is achieved faster with little or no emotional stress on the team members.

~~Inadequate~~<sup>The lack of social awareness can lead to interactions where individuals are not committed engaged cognitively, and find it very difficult to focus their attention on the communication. This can occur<sup>perceptual disabilities of some team members, disability</sup> in the case of remote interactions, ~~disability~~ and situations where ~~doctors, nurses and other medical professionals are operating simultaneously on a patient.~~</sup>

### 1.2.2 Learning Social Awareness

Figure 1.3 represents a simple unidirectional model of social stimulation and reciprocation.

In reality, social awareness is a continuous feedback learning system, where individuals are learning through observing, predicting, enacting and correcting themselves. It is this learning mechanism that allows people to adapt easily from one culture to another with ease - here we refer to the term culture broadly, encompassing work culture, social culture in a new environment, and culture of a new team, etc. Figure 1.4 shows the continuous feedback loop involved in social learning systems, based on the model of human cognition



as proposed by Hawkins [15].

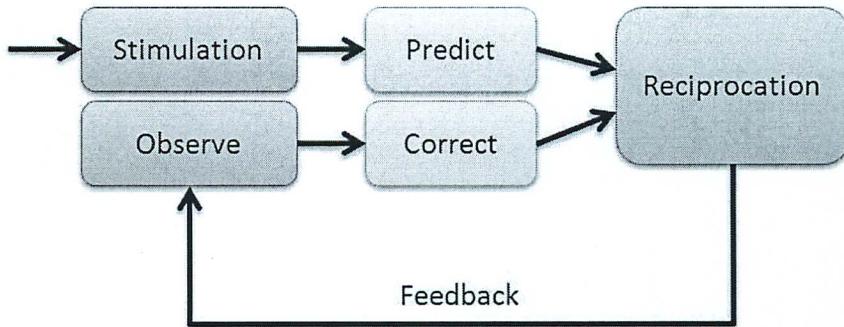


Figure 1.4: Social learning systems with continuous learning feedback loop.

People exposed to everyday social interactions learn social skills from the three different social stimulations (social sight, social hearing and social touch) ~~effortlessly~~. When faced with a new environment, individuals exercise their learned social skills to predict what social actions are appropriate in the <sup>new</sup> setting. Once executed, they observe and assess their counterparts, to determine if their ~~new~~ behavior is appropriate or not for the new setting. Such learning continues until their social rule set adapts to the new environment. Psychologists have been studying the nature of learning that happens in individuals who move from Western to Eastern cultures and vice versa. Largely, USA and Japan have been the countries of choice, based on their economic equality and cultural <sup>contrasts</sup> diversity [16]. In the West, large body movements and excitement in the voice are considered to be typical, and to a large part ~~are~~ encouraged as a good social skill. Similar <sup>-behaviors</sup> attitudes in the East are considered to be inappropriate in professional settings and to a large extent ~~considered~~ indecent. An individual displaying any such inappropriate mannerisms or gestures will receive social feedback from his counterparts <sup>in the form of</sup> everyone staring at the individual, ~~can't reducing their~~ reduced interaction with the individual. Thus, social awareness is a learned set of rules about the environment within which the individual is present, and this requires continuous monitoring of the various social channels of stimulation. Deprivation of any one of these channels can ~~in turn~~ affect the ability of ~~an~~ individual to learn social actions and responses that are pertinent to a social situation. Thus, enriching SSA not only offers the means for individuals to make appropriate social

I don't think  
that many researchers would  
describe Japan as a  
cultural diversity

decisions, but also cognitively trains them towards effective social judgments.

The rest of this chapter argues that ~~the social~~ Rest of this report advocates that the social separation is induced in various human-information impoverishment characteristic of some interaction human interaction scenarios that result in social information impoverishment. Scenarios of such separation are introduced in Chapter 2 as motivations for the proposed technologies that mediate social interpersonal interactions. Effort is made to identify the social separation created due to physical separation of interaction partners and contrast these situations with information impoverishment induced by sensory/physical disabilities in co-located interaction partners. The following section highlights some of the important factors that are important to successful non-verbal communication used by interaction partners while assessing the non-verbal social situations in which they are communicating.

### 1.3 Factors that contribute to the Overall Non-verbal Communication Pattern

The success of communication The complex nature of non-verbal cueing is influenced by various factors relating to the some of which are dependent upon the interaction partners and also to the environment where they are interacting. In order to understand the nature of these cues, psychologists have been studying these cues under three subcategories of influencing attributes based on what affects individual's non-verbal cueing [4]. These subdivisions include,

#### Factors related to the

(a) The communication environment

#### Factors related to the

(b) The physical characteristics of the communicators

#### Factors related to the

(c) The behaviors of the communicators

5 categories are each

Below, these three items are discussed in detail, providing a highlevel discussion on the nature of their influence on the non-verbal communication between individuals.

##### 1.3.1 The Communication Environment

The communication environment (surroundings where the interactions are taking place) makes a huge difference in how humans respond or react [17] [18]. For example, lengthy periods of extreme heat [19] are known to increase discomfort, irritability, reduced work

### *Jazyky a jazykové skupiny*

českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

### *Jazyk a jazykové skupiny*

českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

### *Jazyk a jazykové skupiny*

českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

### *Jazyk a jazykové skupiny*

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### *Jazyk a jazykové skupiny*

českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

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českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

### *Jazyk a jazykové skupiny*

českého jazyka, vývoj jazykových skupin, vývoj jazyků v Čechách.

produce

output, and unfavorable evaluations of others. Along with the interaction partners, the environment either reinforces or depreciates the emotional experience of an individual. For example, wide open spaces and natural environments are known to be conducive for psychological stability [20]. Though such environmental factors are just perceptual, they impose influence on each other. Some of the important environmental factors that affect interpersonal communication and non-verbal cueing are shown in Table 1.1. The table lists these environmental factors and identifies important references from behavioral psychology that have studied the influence of these factors on the non-verbal communication.

Table 1.1: The various factors of the communicator's environment that can affect interpersonal communication.

The Communication Environment	
Familiarity of the environment	[21] [22]
Colors in the environment	[23] [24]
Other people in the environment	See next two subsections.
Architectural Designs	[25]
Objects in the environment	[26]
Sounds	[27] [28]
Lighting	[29]
Temperature	[19]

### Factors related to the Physical Characteristics of the Communicators

The physical appearance of a person is very important aspect of non-verbal cueing. People draw impressions of their communication partner as soon as they engage with them.

The human body acts like means for communicating important sociological parameters like status, interest, dominance etc. Researchers have found cultural and global preferences in overall body image, and any deviations from the norm affects interactions between people.

For example, facial babyishness [30] has been found to affect judgment of facial attractiveness, honesty, warmth and sincerity. Any deviation from the babyishness has been correlated to immediate reduction in the judgment of these traits. Another positive example is the clothing that people wear. It has been found that first impressions are positive if the interviewer and interviewee are clothed similarly [31]. Table 1.2 shows the important aspects of a per-

and the other side of the hill. The water was very clear and I could see the bottom of the lake. I saw many fish swimming in the water. I also saw some birds flying over the lake. The air was very fresh and clean. I enjoyed my walk in the forest and the lake.

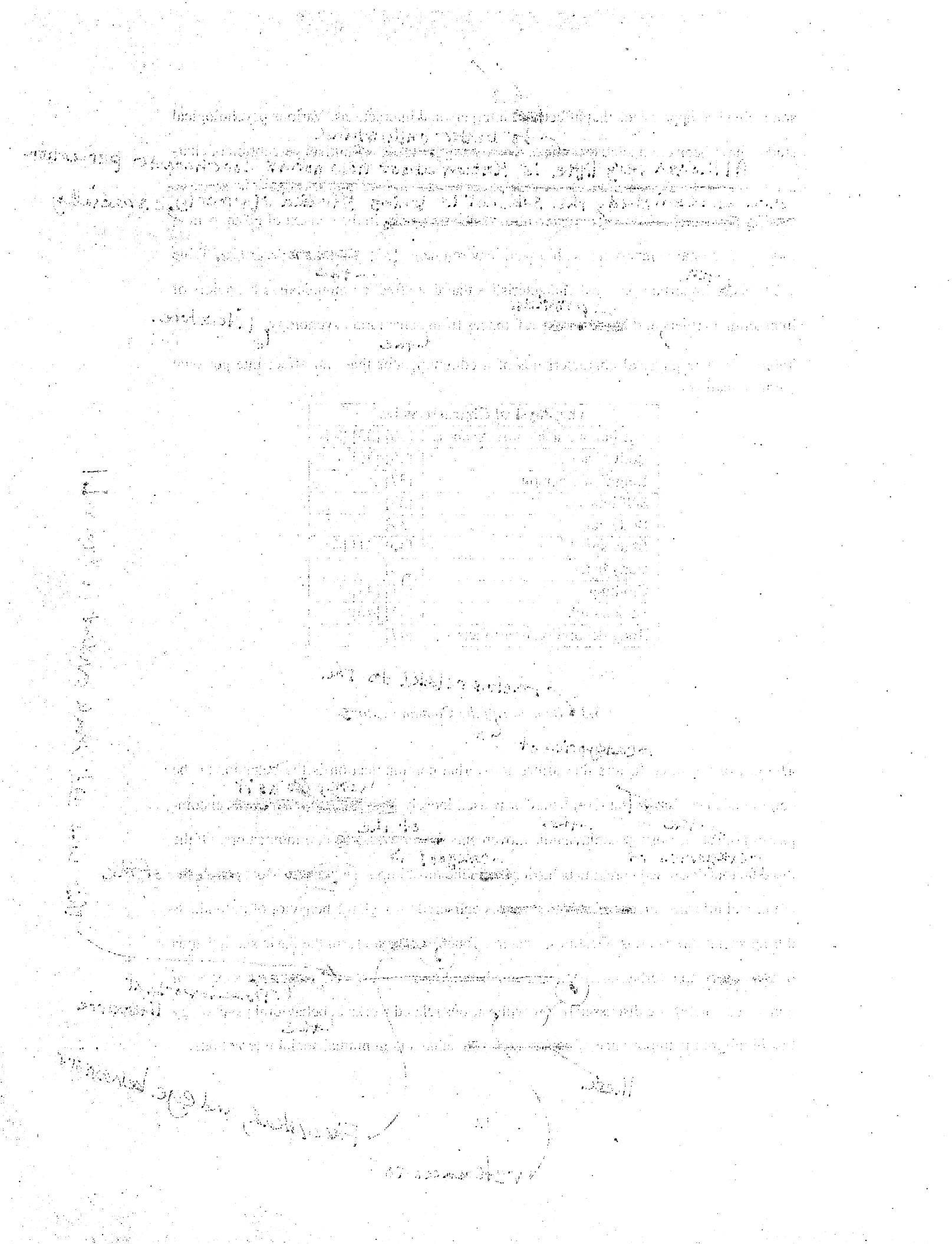
son's physical appearance that affects the interpersonal interactions. Various psychological studies have been conducted towards understanding the model of human perception of character. ~~to better understand~~  
~~Although very little is known about how norms for character perception are established, the subject is being studied vigorously, especially~~  
~~area of research that is being explored rigorously, especially, in the context of group behaviors and personal mannerisms within work environments [32]. Similar to Table 1.1, Table 1.2 lists the important physical characteristics that can affect communicative behaviors of interaction partners and provides the references from behavioral psychology literature.~~

Table 1.2: The physical characteristics of a communicator that can affect interpersonal communications.

The Physical Characteristics	
The human facial attractiveness	[30] [33] [34]
Body shape	[35] [36]
Height of a person	[37]
Self image	[38]
Body color	[39]
Body smell	[40] [41] [42]
Body hair	[43]
Clothing	[31] [44]
Personality	[45] [46]
Body decoration or artifacts	[47]

### 1.3.3 Behavior of the Communicators

The last of the three factors that affect non-verbal communication is the behavior of the communicators. While the term behavior is used loosely in defining this unit, this encompasses both static posture and dynamic movements demonstrated by communicators. Of the three factors discussed here, the behavior forms the most important aspect. Most part of the emotional information encoded by humans is delivered through the behavior of individuals during social interactions. Gestures, Posture, Touch and Voice form the basic subdivisions in behavioral non-verbal cueing as was made evident in Figure 1.1. Important aspects of non-verbal cueing are discussed below with various related works in behavioral psychology literature that highlight the importance of communicator's behaviors in mutual social interactions.



#### 1.3.3.1 Gesture

Gestures are dynamic movement of face and limbs ~~s~~ <sup>s - the</sup> displayed during interpersonal communication. Together, they convey information that can be complimentary ~~with~~ <sup>to</sup> speech, or supplementary to ~~the~~ <sup>or</sup> verbal communication. Most often gestures are classified based on their occurrence with speech. Accordingly, there are <sup>{ typically</sup>

- (a) *Speech-independent gestures*, or emblems (like shrug, thumbs up, victory sign etc), that are mostly visual in nature and convey the user's response to the situation [48] [49].
- (b) *Speech-related gestures*, or illustrators (pointing to a thing, drawing a shape while describing etc) [50].
- (c) *Punctuation gestures*, that emphasize, organize and accent important segments of a communication, like pounding the hand, raising a fist in the air etc.

#### 1.3.3.2 Posture

Posture refers to the temporary limb and body positions assumed by individuals during interpersonal interactions. Posture is a very effective medium for communicating some of the important non-verbal cues ~~like~~ <sup>such as</sup> leadership, dominance [51], submissiveness and social hierarchy [52]. For example, people who show a tendency ~~of~~ <sup>toward</sup> dominance tend to extend their limbs ~~out~~ while sitting thereby displaying an overall larger body size. Similarly, submissiveness seems to be correlated to reducing the overall body size by keeping ~~the~~ <sup>the</sup> limbs together. Both gestures and postures are influenced heavily by the cultural background of the individuals and also ~~varies~~ <sup>very</sup> varies with the geographical location [53] from where they hail.

#### 1.3.3.3 Touch

Social touch ~~is~~ has been a very important aspect of non-verbal communication in humans. Developmental biologists believe that the first set of sensory responses in a human fetus is touch [54]. From a social context this sensory channel is ~~very well used in~~ <sup>useful for</sup> conveying

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important interpersonal cues such as interest, intimacy, warmth, confidence, leadership and sympathy [55]. Touch is a powerful means of unconscious interaction, and it is believed that people who are very good in their social skills rely upon touch a lot [56]. Historically,

The sense of touch (Haptics Communication [57]) has been studied by psychologists in the perspective of understanding the human sensory system, but recently, haptics has grown more by technologists with respect to the role it might play in out into the technology front providing human machine interfaces that augment or replace visual and auditory interfaces [58] with touch encoded data.

#### 1.3.3.4 Face/Head

In fact, the face, together with the head, is the primary channel for non-verbal communication. Humans are efficient in conveying and interpreting a plethora of information through subtle movements of their face and head. The facial appearance of an individual is due to their genetic makeup, transient moods that stimulate the facial muscles and due to chronically held expressions that seem to set in and become permanent. Relying on the face for non-verbal cues develops from a very young age and it has been shown that by 2 months, infants are adept in understanding facial gestures and mannerisms [59]. The human face has very fine muscular control allowing it to perform complex patterns that share a lot of commonality among humans while being vastly individualistic [60]. Human visual system has developed the ability to read these subtleties on people's faces and interpret all the three aspects of the face - genetic makeup (person's identity through face recognition), transient mood (facial expression and emotion recognition), and permanent expression on the face (default or neutral face of individuals). While the aspects of permanent facial appearance are important in the recognition of the individual, from a non-verbal communication perspective, the primary function of the face is directed towards communicating emotions and expressions.

are widely understood  
is able to interpret subtle differences between as well as transient changes

The understanding of the human facial expression space was immensely increased by the work of Ekman, Frisen [61] and Izard [62] in the late 1970s. They independently measured precise facial movement patterns and correlated these localized individual movements with facial expressions on the human face. While Izard developed these patterns on infants, the Facial Action Coding System (FACS) developed by Ekman and Frisen has become

He was a man of great energy and determination, and he had a clear vision of what he wanted to achieve. He believed in the power of education and the importance of providing opportunities for people to improve their lives. He was a strong advocate for social justice and equality, and he worked tirelessly to promote these values.

१०८ विष्णु वाचना विष्णु वाचना विष्णु वाचना विष्णु वाचना विष्णु वाचना

10. *Leucosia* *leucostoma* *leucostoma* *leucostoma* *leucostoma* *leucostoma* *leucostoma*

在於此，故其後人之學，亦復以爲子思之傳。蓋子思之學，實出於孟子，而後人不知，故以爲子思之傳也。

Consequently, the *labeled* and *unlabeled* samples were analyzed by the same method.

10. The following table gives the number of cases of smallpox reported in each State during the year 1802.

卷之三

卷之三

10. The author's name is John Smith.

在這裏，我們要指出的是，當我們說「社會主義」的時候，我們所指的並不是某一個國家的社會主義，而是全世界的社會主義。我們所指的並不是某一個民族的社會主義，而是全世界的社會主義。

Table 1.3: FACS communicative actions on the human face

1	Inner Brow Raiser	24	Lip Pressor
2	Outer Brow Raiser	25	Lips part
4	Brow Lowerer	26	Jaw Drop
5	Upper Lid Raiser	27	Mouth Stretch
6	Cheek Raiser	28	Lip Suck
7	Lid Tightener	29	Jaw Thrust
9	Nose Wrinkler	30	Jaw Sideways
10	Upper Lip Raiser	31	Jaw Clencher
11	Nasolabial Deepener	32	Lip Bite
12	Lip Corner Puller	33	Cheek Blow
13	Cheek Puffer	34	Cheek Puff
14	Dimpler	35	Cheek Suck
15	Lip Corner Depressor	36	Tongue Bulge
16	Lower Lip Depressor	37	Lip Wipe
17	Chin Raiser	38	Nostril Dilator
18	Lip Puckerer	39	Nostril Compressor
19	Tongue Out	41	Lid Droop
20	Lip stretcher	42	Slit
21	Neck Tightener	43	Eyes Closed
22	Lip Funneler	44	Squint
23	Lip Tightener	45	Blink
		46	Wink

the *defacto* standard for measuring facial expressions and emotions in individuals. FACS allow researchers to encode facial movements into accurate contraction and relaxation of facial muscles. Based on these facial actions, Ekman and Frisen discovered the global occurrence of six basic emotions, namely Happiness, Sadness, Anger, Disgust, Fear and Surprise. These six emotions have been found to be common across cultures and Surprise. The emotions have been found to present beyond cultural diversities and age levels, which has further motivated technologists to base human machine interaction basics on these emotion primitives.

#### The detection of

The Facial Action Coding System (FACS): FACS is a systematic description of all possible facial movements in terms of muscular contractions and relaxations. Action Units (AU), which forms the basis of FACS, encode facial feature movement patterns into 5 distinct levels of movement (A, B, C, D and E) correlating to the intensity of their movement.

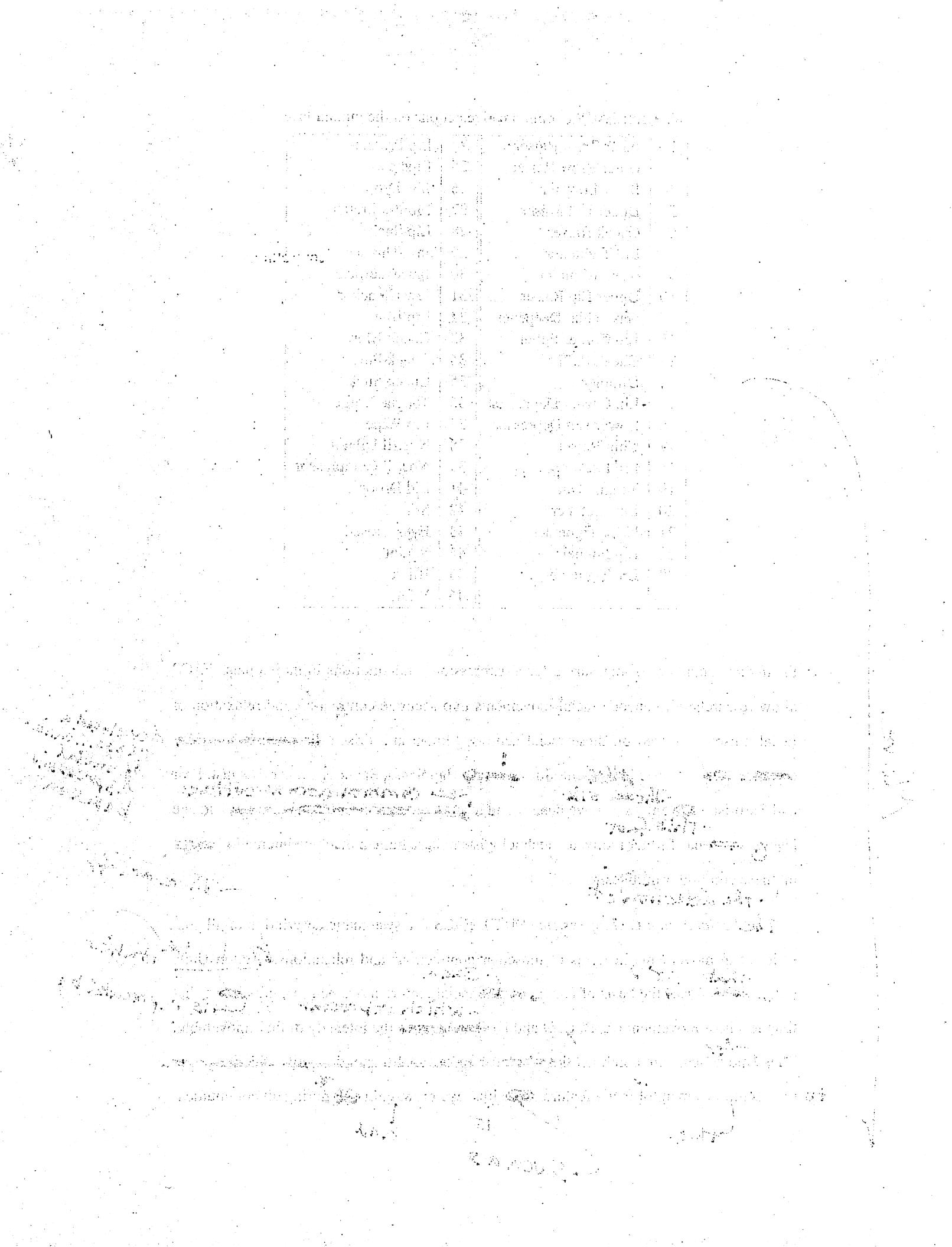
These movements are combined into 32 basic units and 14 extended units which together

to represent movement of facial features like lips, eye brow, chin etc during all communication

developed a classification of facial expressions based on

There are 46

italics



# Table 1.3

1.3

42

tive interactions. Table below shows the different AUs that form the basis of FACS based facial coding with the appropriate number and the associated facial feature movement.

a short description of

## 1.3.3.5 Eye

Finally, the human eye, like the human face, plays an important role in controlling non-verbal communication behaviors among interacting individuals. This involvement of human eyes is emphasized by the functions that gaze and mutual gaze play in everyday human interpersonal communication [63]. People use gaze to convey subtle information that enables smooth verbal interaction which eventually leads to information exchange [64]. The function of gaze has been classified into four important functional categories [65]. These include

Table 1.4: The role of human eye in interpersonal communications

Regulating the flow of communication	One of the most important functions of gaze is the regulation of verbal communication in bilateral and group communications. People use gaze to shift focus, bring the attention of a group of people to one thing, turn taking in group conversations [66] and eliciting response from communication partners [67].
Monitoring feedback from the listener	Gaze provides a means for individuals to get feedback during conversations and communications. Feedback is very important while people converse. Humans study the eyes of the listener to cognitively inject or eliminate verbal information from the conversation [68].
Reflecting cognitive activity of the communicator	Both listeners and speakers tend not to gaze at others when they are processing complex ideas or tasks. Studies have shown that people can answer better when they close their eyes and are allowed to process their thoughts [69]. Thus, cognitive processing is displayed very elegantly through eye gaze patterns.
Expressing emotions	Along with the facial muscular movements, the eyes play a vital role in the expression of emotions. In fact, in human computer interaction research, it has been found that relying on the eyes and the eyelids alone can provide more accurate delivery of affect information when compared to the entire face [70]. Verbal communication tends to move the lips and mouth quickly and randomly that can make image and video processing of expressions very tough. Some of the more recent spontaneous expression recognition research is focusing on the eyes for this reason.

This difficult

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exclusively

than relying  
on eyes

the



## Facilitating the 1.4 Mediating Social Interactions through Enrichment of Social Situational Awareness

From the above discussions, it can be argued that the social interactions between individuals can be affected positively by enriching their social situational awareness. That is, enhancing ~~their access~~ ~~that~~ ~~the awareness of individuals to social cues in their environment could potentially increase more fully engage them socially,~~ ~~more effectively~~ ~~rest of this book discusses the importance of social cue enrichment under various conditions and demonstrates the one applicable area of human interpersonal communication enrichment in people who are visually impaired.~~ ~~In doing so, emphasis is placed on understanding the importance and priority of social signals, developing sensing technologies that can extract social cues from the communicative environment, and developing technologies that can deliver any extracted social information back to the users of the technology with minimal sensory load.~~ ~~and cognitive~~

## 1.5 Organization of the Book



