BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS)
ISSN (P): 2348–0521, ISSN (E): 2454–4728
Vol. 11, Issue 1, Jun 2023, 65–76

THE RATIONAL COMPONENT IN EMOTIONS AND ITS RESULTANT DISPLAY IN SPEECH PRODUCTION

DR. ANNA ROSTOMYAN[1] & DR. NICOLA SARANDRIA[2]
Lecturer at Berlin School of Business and Innovation, Germany
OMCEO Vicenza, taly

ABSTRACT

In our everyday life we are constantly faced with different stimuli that have an impact on our internal psychological states. Our inner psychology can give rise to very may different emotions and feelings that can greatly influence our verbal and non-verbal behaviour.

The present paper shed a light on the differences between emotion and feeling, as well as provides the reader with arguments on the interconnection of the rationality and emotionality in the higher cognitive processes.

It also discusses how verbal manifestation of emotions are processed by the brain and how to reach an emotive impact on the listeners through intensification.

KEYWORDS*:* Emotions, Feelings, Emotionality, Rationality, Intensification.

Acknowledgements: We thank everyone on our journey who have had an influence on ourselves and on our academic studies, including especially our family members, faculty, and friends.

INTRODUCTION

Emotions are easily recognized, but way hard to define. Emotions involve our physiology, thoughts, subjective feelings, motivation, aspiration, intentions through verbal and non-verbal expressions in our verbal and non-verbal behaviour. They are instant impulses to act in response to an outward stimulus that evolution has instilled in us for handling life.

During an emotion, these facets of bodily and mental activity suddenly seem to operate in concert. For example, when our hearts beat faster, we feel warmth, our minds go blank except for a deep desire to connect, we lean in close, and we pucker our lips – this is when we recognize a moment of love. We lower our lips when we are saddened by a certain fact. Yet just before that emotion episode, hearts were already beating (to circulate blood), the target of affection was already in view, and thoughts filled with the conversation at hand.

Feeling and emotions are concepts that in the English language are quite well divided. Separate entities each with its own meaning and each with its own physiological value, aided by the elasticity given by the English language.

Feeling is a cognitive process, elaborated in the cortical areas of the mesencephalon. Emotions are the physiological and bodily reactions to the feeling. A set of hormonal, arterial blood pressure and biological phenomena which make us aware of the “feeling”.

THEORETICAL BACKGROUND

Emotional systems are quite intrinsically interconnected with the environment and the physiological and behavioral reactions associated with it. This is strongly rooted within the human neurophysiological system. In fact, the nervous

system has a fundamental entity in terms of its role in emotions, the amygdala (Murray, 1964; Goleman, 1995).

There is a very important center in the brain that is responsible for the storage of emotions, namely the amygdala. The amygdala is fundamental for its functioning within the realm of emotions processing and management (Rolls, 2022). There are two important circuits involved in emotions:

- the circuit involving thalamus-cortex-amygdala path.
- the circuit involving thalamus-amygdala path.

In the circuit involving thalamus-cortex-amygdala, the sensory information arrives at the thalamus, from which reaching the sensory cortex and then the associative hippocampal area and amygdala-anterior brain. It is precisely from the anterior brain that efferent paths reach effector systems leading to motor response, endocrine responses and autonomous ones. These responses can be appreciated in the resulting facial expressions associated with emotional reactions and other somatic reactions.

To attach an emotional 'tag' to stimuli coming from the surrounding environment and from internal 'body'-associated' stimuli, the amygdala is fundamental, as it also attaches emotional significance to more 'central' inputs like memories and thoughts. As a matter of fact when emotions are evoked, there is no real difference whether the original input was 'real' or external or whether it was 'imagined' and a more internal type of stimuli. It is the hippocampal connection with the amygdala which leads to the proper modulation of these actions of the amygdala. The amygdala, being in a two-way circuit, can send projections to the hippocampus and from there can influence perception, memories and thoughts by reaching previously activated cortical areas. And it is precisely for the hippocampal and amygdala interaction that the mutual influence of cognitive processing and emotional 'tag'takes place (Rolls, 2022).

The circuit involving thalamus-amygdala pathis quite different, being monosynaptic interaction involving the amygdala and the thalamus. This interaction allows a more direct and fast response to the stimulus received. A simpler response and in fact it is a system that is shared with animals who have not neocortex development and it is a system also used by very young children. The thalamus-amygdala path acts in adults even before the objects are recognized and it can act as a preparatory system for the amygdala, allowing it to elaborate more complex information for the aforementioned more elaborate system which is the thalamus-cortex-amygdala path. Therefore, it can be said that the thalamus-amygdala path is the one responsible for the management of faster responses and raw stimuli processing (Sun-hui Xia, 2020).

Several experiments have been performed in order to assess the roles in terms of processing emotional and cognitive information by the amygdala and the hippocampus.Many of these experiments were performed on monkeys. In one such experiment, the monkeys were divided in different groups and their behaviors were studied (Chudasama, 2009). In this study, the amygdala and hippocampus were a point of focus and it showed that lesions in the amygdala caused an aberrant interest on the part of the monkeys to creatures which normally would cause them fear, such as snake and spiders, while damages to hippocampus caused a missing emotional reaction to the snake or the spider. Therefore, this showed the independent contributions of hippocampus and amygdala to the defensive reactive responses.

It is a complex phenomenon, the feeling-emotion axis, which gives neuroscientists all over the world food for thought. Is it the feeling that sends through descending cortical pathways messages through neurotransmitters and neuro-endocrine interactions to the body giving rise to emotions or the other way around?

Here come into play the theories of the James Lange (1884/85) and Cannon-Bard (1927/28). The first theory is focused on the physiological change being the cause of the sensation of emotions (so quite simplified in comparisons with the second theory as it attributes emotion to a simple physiological change) while the latter is based on the concept that the emotions are the result of the functioning of neurophysiological substrates including hypothalamic structures acting on the thalamus, actuator of the emotional feeling (Simonov, 1997).

For the revelation of the emotional reactions these two aforementioned theories, i.e. the James-Lange and Cannon Bard theories give different explanations, namely the James-Lange theory, according to which according to which emotional arousal happens after some psychological physiological changes of the body, and the Cannon Bard theory of emotions, according to which an outward expression happens after the emotions recognized and processed by the brain. The Cannon-Bard theory is therefore rooted on the basis of giving vital importance to the neuroanatomical region known as the limbic system, comprising of hypothalamus, thalamus, amygdala and hippocampus (McLachlan et al, 2009).

According to the well-known neuroscientist Antonio Damasio (1999), an emotional stimulus first evokes physiological affective reaction in the human body (Lat. afficere/affectum = state of mind caused by a stimulus). Then the impulse is conveyed by the nervous system to the brain where it forgoes ahead through amygdala and some other important parts of the human brain to the frontal lobe, where it is finally understood as an emotion (Lat. emotion = e- = away, movere/motum = to move), which hints to the fact that there is always some action involved with the realization of emotion according to the favourability of the felt emotion and how the brain processes it.

Thence, emotions are "conscious feelings". The conscious experience of emotions seems to be primarily shaped by the somatosensory association cortex of the right hemisphere. In this way, the physical symptoms of emotional arousal can be integrated into a unified emotional self-perception (Damasio, 1997: 194-226). In addition, there is a high probability that emotional excitement also has a direct influence on the cortex. In this way, the general level of cortical arousal can change. In addition, our attention is primarily focused on emotionally relevant contents of consciousness (LeDoux, 1996: 225-303).

In fact, our brain is formed up of two hemispheres, namely the left and the right ones, which are responsible for different functions. To be more exact, the left brain is responsible for logic, analytical analysis, data and facts, etc., whereas our right brain is responsible for imagination, arts, creative thinking and intuition, where emotions mainly reign.

The hypothalamus is a fundamental part of the Central Nervous System, being a structure of particular interest located in the central area inside the two cerebral hemispheres. It is includes several nuclei that lead to the control, activation and integration of autonomic processes, endocrine responses and different somatic reactions such as sleep cycle, thermal regulation, hydro-saline balance and feeding behaviors. The hypothalamus controls many activities related to homeostasis and also controls the pituitary gland.

A great example of the complexity of emotions, feelings and the role intertwined with language is the meso-limbic and meso-cortical pathways (Piantadosi, 2021). Exempli gratia: a human imagining a bright event which he knows will happen in the nearby future. The cognitive process in the aforementioned pathways will cause a "bath" of Dopamine which will cause a feeling of wellbeing, excitement and happiness. The anticipation combined with imagining the greatness of such event will cause a feeling and emotional reaction of joy. Now, often times, when the much-anticipated events actually take place, the same person who imagined the event in its own cortical pathways and had such a great

feeling and emotion, will feel "let down". The happiness will not reach the same level as the one he/she felt during the imaginary anticipatory phase as the event took place in real life, in a real world with real people and not in a perfect imaginary world, where the person is its creator and ruler and can shape the imaginary events taking place in the cortical areas of the brain in the way leading to the highest amount of "dopamine bath".

The basic emotion view identifies a list of discrete, basic emotions that should meet specific criteria, such as having distinct physiology, expressions, experience, and so on (Ekman & Cordaro, 2011). The classic basic emotion list includes *sadness, fear, disgust, anger, surprise*, and *happiness*.

Despite some contradictory viewpoints in science concerning the essence of what emotions typically are, psychologists mostly agree that they involve the intersection of a few components, typically:appraisals, mental assessments of circumstances, interpretation of things, physiological changes in the body (e.g. sweaty palms and racing hearts) and brain processing followed by expressions in the face (e.g. a smile), as well as in posture, tone of voice, and touch, subjective experience: our personal, first-person, phenomenological feeling, action tendencies, motivation to do some things rather than others (e.g. flee or explore).

Although there is no definitive solution to the question of the relationship between emotional experience and bodily expression, a most sensible hypothesis has been put forward by Magda Arnold. First of all, she says that most of the emphasis has been on the second half of the sequence – emotion, expression, action – and not on the initial perception. She also points out that not every perception leads to an emotional reaction, so that there has to be some mechanism for appraising the situation (cited in Murray, 1964: 50)

In fact, one of the main hypotheses of Dr. Anna Rostomyan (2013) is that emotions should be regarded in separation from the feelings, which are more of a sensational nature. One of the main statements of Dr. Rostomyan in her dissertation "A Linguo-cognitive Analysis of Verbal and Non-verbal Expressions of Emotions (on the material of English)" defended in tight collaboration of Yerevan State University (Armenia – her alma mater) and the University of Fribourg (Switzerland – with a PhD research grant) that emotions have a cognitive nature, which is manifested in our behaviour through verbal and non-verbal markers, and that emotionality and rationality go hand in hand in forming the basis of our higher cognitive processes.

In tune with modern theorists of emotions (cf. Ortony, Clore, LeDoux, et alias), we regard emotions essentially as subconscious signals and evaluations that inform, modify and receive feedback from higher cognitive processes. In a sense, we have to admit that human beings have two minds which are closely interrelated – *emotional* and *rational* (Rostomyan, 2020: 74).

All this comes to suggest that emotions are not extinct from rationality and that there is a subtle link between emotionality and rationality, which together frame the working procedures of the higher cognitive processes (Rostomyan, 2022).

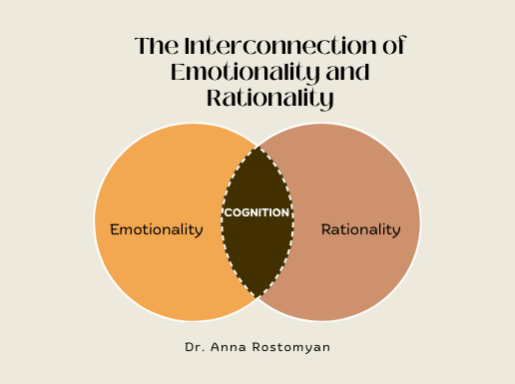

Figure 1

Chart source: Dr. Anna Rostomyan (2013)

The chart above illustrates the interconnection of emotionality and rationality, which form the harmonious interflow of our higher cognitive processes. Usually, there is a balance between these two, yet under an emotional moment, the emotional mind may prevail and one may consequently lose control over the expressions of emotions, for which there are different management techniques

Moreover, nowadays the term "Emotional Intelligence" is very in vogue popularized by Daniel Goleman through his book "Emotional Intelligence" (1995). According to Goleman, emotions can be wise indicators of favourability and unfavourability of the outward situation and can guide us through life.

Since both our emotions and our speaking abilities are linked to our higher cognitive processes, emotions may sometimes find their verbalization in speech.

Here, it should be noted that sometimes by means of applying some techniques we can also have an emotional influence on the listeners by means of using emotive boosters, i.e. intensifiers.

According to V. Buzarov (1998), *intensifiers* are function words that enhance the emotional content of the word that they *are attached to or to the whole sentence. These can be such words as unbelievably, greatly, truly, wondrously, fantastically, wholly, really, fully, marvelously, etc.*

Intensifiers are also grouped according to their applied meaning, i.e. (a) positive: tremendously, wondrously,incredibly, marvelously,fabulously, fantastically, fantabulously, etc., (b) negative: damn(ed) if, darn(ed) if, goddamn(ed), who/what/why/where/what the hell, (in) the helletc., (c) context-dependent: very, pretty, damn, awfully, frightfully, crazily, dreadfully, terrifically, etc. (Rostomyan, 2020: 34-35).

With the help of intensification, you can express you truly felt emotions in a more enhanced manner subtly suggesting your listeners what emotions they should feel. In fact, when we use positive emotive booster words (even in self talk) positive hormones flow. Moreover, positive talk releases endorphins and serotonin in our brain, which then flow throughout our body, eventually making us feel good about ourselves and our relationships. On the contrary, these very positive neurotransmitters stop flowing when we use negative words in our speech.

In terms of the verbalization of emotions, we have to state that they are depicted through a distinct pitch in speech, which can be observed with both negative and positive stances of intensification.

MATERIALS AND METHODS

For the indication of emotions in speech and their interrelation with our higher cognitive processes in speech primary data have been collected through experiments through the tool Praat, which revealed the application of higher pitch in the pronunciation of intensifiers. As for secondary data, different research from other scientists on the interrelation of emotional and rational minds have been taken into account.

DATA ANALYSIS

Our data analysis has shown that emotions are usually expressed in a higher pitch.

P. Ladefoged (1992: 14-23) claims that we use the term pitch when we are referring to the aspect of highness or lowness of tone, placing on a scale going from low to high. That is to say the quality of a sound governed by the rate of vibrations producing it; the degree of highness or lowness of a tone. It is only varied when the frequency of a sound is altered. Hence, sounds produced by a given tuning fork will all have the same pitch, although they may vary in loudness. Only by altering the length of the pendulum or the size of the tuning fork can we alter the duration of the cycle, and so vary the frequency. In our case, the size of the vocal cords plays a crucial and vital role: the heavier vocal folds of men generally produce a lower pitch that the women's vocal cords, which are usually smaller and lighter. This is because a heavy string of a given length and under a certain tension will vibrate more slowly than an equally taut light string of the same length. According to Ladefoged, vocal cords vibrate more rapidly when under greater tension: we might think that undergoing certain emotions the vocal cords might be under higher tension than in a relaxed situation, hence, the pitch is higher.

In 2020, Dr. Anna Rostomyan carried out an analysis on the nature of intensification and intensifiers in voice at the University of Hamburg in native and non-native English speakers.

Let us examine the pitch of the intensifying adverbs "very" and "really" in the following sentences: "You are a very bad animal" and "I really am very hungry".

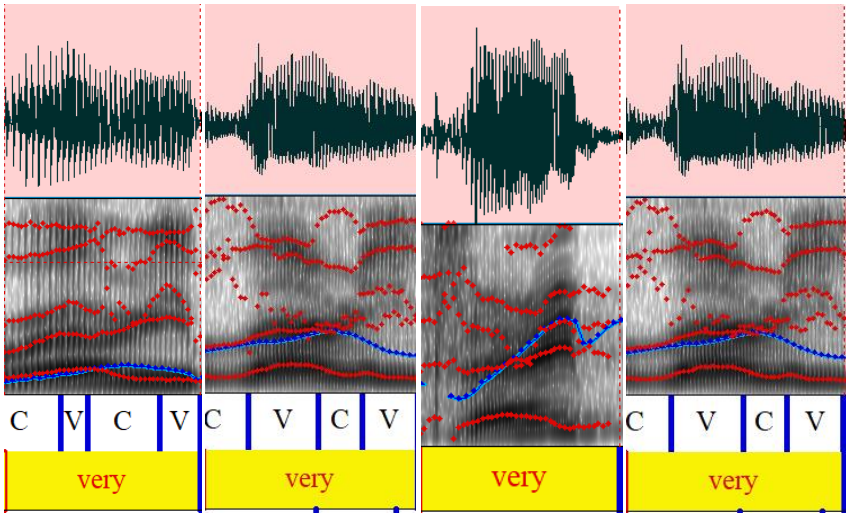

Figure 2

1. Spectrograms of the articulation of the intensifying adverb "very" by a British native speaker (picture 1) and 3 non-native German L2 English Speakers.

As we see from the pictures depicted above, the British speaker pronounces the intensifying adverb “very”, which in this case plays the role of a negative intensifier, as the overall meaning of the speech act is negative, besides the adjective to which it is attached to is itself negative, i.e. “bad”. The pitch of the native speaker is rather low, as she is upset by the state of the affairs and pronounces the intensifier in a low pitch, thus, showing her negative emotions. Nevertheless, the pitch of the L2 non-native speakers is higher, as they subconsciously knowing that intensifiers generally should be stressed and pronounce it in a higher pitch. It is noteworthy that the pitch of the 3rd speaker is even creaky.

In fact, “very” is a context-dependent intensifier: it can attach both positive and negative intensification depending on the context. For example, “very happy” (positive) and “very sad” (negative).

Below, we can observe the chart depicting the F1 and F2 axes of the articulation of the intensifying adverb “very” bearing negative intensification.

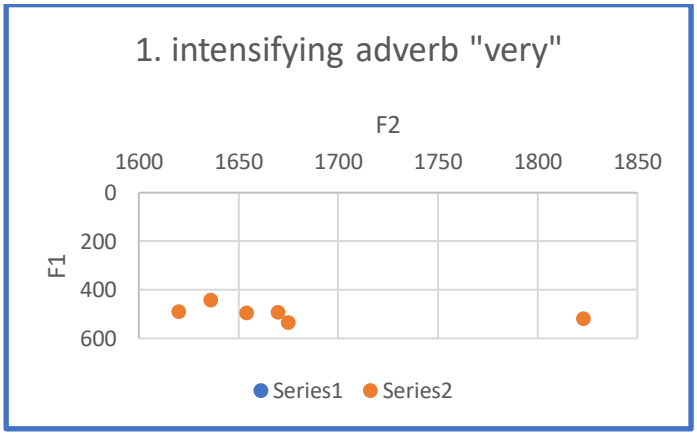

Figure 3

One of the German speakers appears to be far in the chart, but the other four articulate the aforementioned intensifier quite similar to the native speaker.

The average F1 frequency of the pronunciation of the intensifying adverb “very” in this case is 496 Hz, and the F2 is 1680. All in all, the intensification and pitch are a bit lower in case of the negative emotion sadness as compared to anger, resentment, or rage.

Now, let us examine other stance of pronunciation of the intensifier “very” in the sentence “You are a very bad animal”, where the speaker, the mouse, is angry with the tiger.

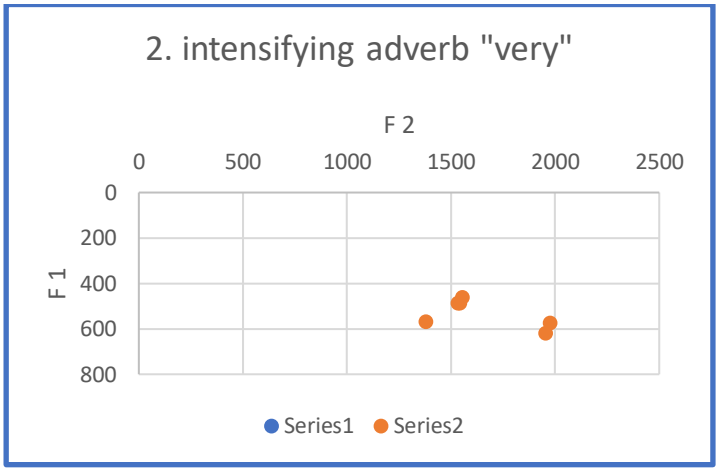

Figure 4

In this case, we can observe that the British speaker and German English speaker are very close to each other (F1 – 486 Hz each and F2 – 1541 Hz and 1532 Hz). The average F1 is 533 Hz and F2 1656. In fact, the numbers show that the average F1 in case of anger is higher than the F1 in case of sadness, as illustrated above.

Let us now analyze another case of "very" in the sentence "I really am very hungry…" In this case, we observe a positive intensification, as the tiger is very happy having found something to eat; hence, he uses the intensifying adverb "very" to enhance and reinforce the meaning of the speech act and to give intensification to the whole statement.

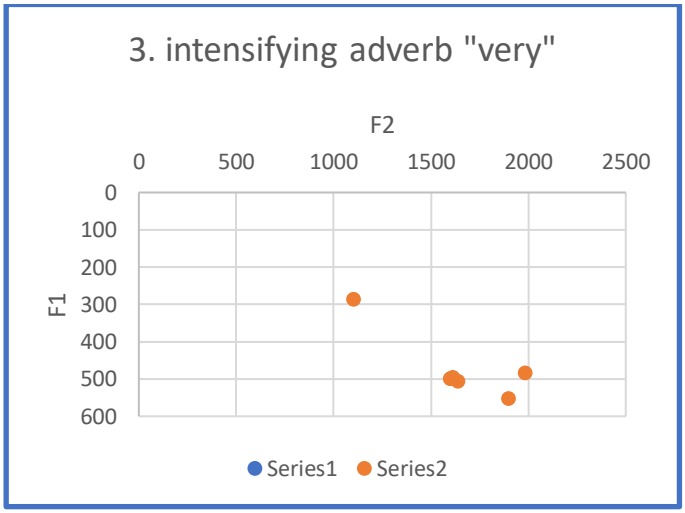

Figure 5

As we can observe, the formants of the pronunciation of the intensifying adverb "very" are quite similar to the previous chart and we can conclude that both in case of anger and happiness the frequencies of "very" are very similar, giving emotive force to the statements. This comes to prove that both positive and negative intensifications stand out in speech.

Happiness is in fact a transient and delicate event in real life, and the most cynic of scientists could even state that for the aforementioned reason happiness in real life is fleeting, lasting only seconds as the imaginary world, a perfected and unreal one, crushes with our surrounding reality. Thence, if we evoke happiness by means of intensifiers, we also positively influence our interlocutors.

As a matter of fact, dopamine is a neurotransmitter of the catecholamine family and its main role is in "rewarding" us with a feeling of happiness and wellbeing after certain events (such as eating good food, drinking water, having a satisfactory job or being in love). These events include speech. Hearing a word of love would lead to a bath of Dopamine and an activation of these neurological pathways described before.

In terms of differences between gender, interestingly through magnetic resonance imaging, a study showed the responses of men and women were opposite in the right anterior area of the insular cortex. All of this happened at the University of California in Los Angeles (UCLA) group led by Paul Macey, and aroused interest because the insula area is linked to the experience of emotions and self-awareness, as well as the control of blood pressure (Macey, 2016). Specifically, it was seen that - linked to blood pressure - in men there was a more intense activation of the indicated brain area while in women the response was more contained. The insula is also at the center of much research because it is the seat, not of conscience, but of emotions, cognitive abilities and stress responses as seen in this Californian research. There is a theory supported by Seymour Levine (2010) hat if a person constantly suffers from stress the response is less and less. American researchers (Macey, 2016). evidently make this hypothesis to them when attempting an interpretation of the lesser reaction in women to the same effort as men. But there are certainly other dimorphisms. For example, the fibers that join the right hemisphere and the left hemisphere are much denser in women than in men. Men are more "slaves" to the left hemisphere which pushes them to do things on time, and one after the other.

Language has a complex effect on the perceptions of happiness, also depending on which language is used. An example could be the Italian language. Differently from the English language, there is no distinction between "emotions" and "feeling". Hence, the perception of a "cognitive" sensation and a more "visceral" one, what the Anglo-Saxons would define as "gut feeling" is not as strongly present, perhaps due to a more passionate cultural background of the Italian culture, set in a more visceral and passionate concept of feeling and emotions.

Interestingly enough the Italian language has an important linguistic difference in comparison to the English language. The concept of "love". In Italian there are two words indicating love. "Ti voglio bene", meaning "I love you" but of a type of love which is referred to a dear friend, a sibling or towards family. And then there is a second type of linguistic "love" in the Italian language. "Ti amo", which is "I love you" but a romantic love usually. A love that is destined towards a special person. And therefore, its effect on the cognitive and neuro-endocrine system of the person is different. The two types of linguistic "love" have different effect while in the English language, the type of linguistic use of "love" is linked with the context.

The data analysis of the data comes to suggest that second language learners are aware of the relevance of the intensity of emotive markers in speech and try to imitate them accordingly with an enhanced pitch to be able to gain an emotional influence on the listeners and to sound more native-like.

DISCUSSION

As we have seen, emotions can be manifested in speech through emotive markers, namely intensifiers, which enhance the overall emotional content. Moreover, having an influence of our neural system, they have the greatest potential of having an influence on our higher cognitive processes in the coding and decoding processes, which results in feeling the expressed emotions by the interpreters. Besides, since emotions are not mere sensations and have rational elements in them intermingling with the higher cognitive processes, by means of applying emotions in speech we also influence the

cognition of the listener(s). This gives us the ultimate chance of having an emotive influence on the listeners; thence, we have to be very careful with it and use it appropriately and to the right degree not to cause confusion or misunderstandings.

CONCLUSIONS

To sum up with, emotions do not exist in isolation from cognition. Moreover, emotionality and rationality are tightly interconnected forming a whole unity are in continuous interaction with one another. This brings us to the assumption that as intensifiers have the ultimate chance of influencing and having an emotive impact on the interlocutors, they can also affect the higher cognitive processes. Thence, in case we wish to create a positive atmosphere in our environment we can adhere to positive emotive boosters and positively emotionally influence our interlocutors. Therefore, in order to be skillful communicators, we have to pay attention to those tiny little wordings, namely intensifiers, as well as take into consideration the interflow of emotionality and rationality while interacting with one another.

REFERENCES

1. Arnold, M. (1960). Emotion and Personality. New York: Columbia University Press.
2. Barrett, L. F., & Russell, J. A. (1999). The structure of current affect: Controversies and emerging consensus. Current Directions in Psychological Science, 8(1), 10–14. https://doi.org/10.1111/1467-8721.00003
3. Buzarov, V.V. (1998). Essentials of Conversational English Syntax, second edition, revised and enlarged, Moscow: Crone-press.
4. Chudasama Y, Izquierdo A, Murray EA. (2009). Distinct contributions of the amygdala and hippocampus to fear expression. European Journalof Neuroscience, 30(12), pp. 2327-37. doi: 10.1111/j.1460-9568.2009.07012.x. Epub 2009 Dec 10. PMID: 20092575; PMCID: PMC2852103.
5. Damasio, A. R. (1997). Descartes' Irrtum. Fühlen, Denken und das menschliche Gehirn. München: dtv.
6. Damasio, A.R. (1999). The Feeling of What Happens: Body and Emotion in the Making of Consciousness. New York: Harcourt Brace.
7. Darwin, C. (1872). The Expression of the Emotions in Man and Animals. Oxford: Oxford University Press.
8. Ekman, P. (1982). Methods for measuring facial action. In K. R. Scherer & P. Ekman (eds), Handbook of Methods in Nonverbal Behavior Research (pp. 45–135). New York: Cambridge University Press.
9. Ekman, P. (1992). Facial expressions of emotion: New findings, new questions. Psychological Science, 3(1), 34–38. http://doi.org/10.1111/j.1467-9280.1992.tb00253.x
10. Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic?Emotion Review, 3(4), 364–370. http://doi.org/10.1177/1754073911410740 Ekman, P., &Davidson, R. (1993). Voluntary smiling changes regional brain activity. Psychological Science, 4(5), 342–345. http://doi.org/10.1111/j.1467-9280.1993.tb00576.x
11. Ekman, P., Davidson, R. J., & Friesen, W. V. (1990). The Duchenne smile: Emotional expression and brain physiology. Journal of Personality and Social Psychology, 58(2), 342– 353. http://doi.org/10.1037/0022-3514.58.2.342
12. Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. Journal of Personality and

Social Psychology, 17(2), 124–129. http://doi.org/10.1037/h0030377

13. Ekman, P., Levenson, R., & Friesen, W. (1983). Autonomic nervous system activity distinguishes among emotions. Science, 221(4616), 1208–1210. http://doi.org/10.1126/science.6612338
14. Gasper, K. (2004). Do you see what I see? Affect and visual information processing. Cognition & Emotion, 18(3), 405–421. http://doi.org/10.1080/02699930341000068
15. Goleman, Daniel (1995). Emotional Intelligence: Why it matters more than IQ. New York: Bantam Books.
16. Izard, C. E. (2010). The many meanings/aspects of emotion: Definitions, functions, activation, and regulation. Emotion Review, 2(4), 363–370. http://doi.org/10.1177/1754073910374661
17. Juslin, P. N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? Psychological Bulletin, 129(5), 770–814. http://doi.org/10.1037/0033-2909.129.5.770
18. Ladefoged, P. (1992). Elements of Acoustic Phonetics. 2nd edition. Chicago and London: The University of Chicago Press.
19. LeDoux, J. E. (1994). Cognitive-emotional interactions in the brain. In P. Ekman & R. J. Davidson (Eds.), The Nature of Emotion. Oxford: Oxford University Press. 345, pp. 216-224.
20. LeDoux, J. E. (1995). In search of an emotional system in the brain: Leaping from fear to emotion and consciousness. In M. S. Gazzaniga (Ed.), The Cognitive Neurosciences. Cambridge: MIT Press, pp. 1049-1062.
21. Macey Paul M., Rieken Nicholas S., Kumar Rajesh, Ogren Jennifer A., Middlekauff Holly R., Wu Paula, Woo Mary A., Harper Ronald M. (2016). Sex Differences in Insular Cortex Gyri Responses to the Valsalva Maneuver, Frontiers in Neurology, DOI: 10.3389/fneur.2016.00087
22. McLachlan RS. (2009). A brief review of the anatomy and physiology of the limbic system. Canadian Journal Neurological Science,36 (2), pp. 84-7. PMID: 19760912.
23. Murray, E. J. (1964). Motivation andEmotion. New Jersey: Prentice-Hall, Inc., Englewood Cliffs.
24. Piantadosi, P., Halladay, L., Radke, A. and Holmes, A., 2021. Advances in understanding meso-cortico-limbic-striatal systems mediating risky reward seeking. Journal of Neurochemistry, 157(5), pp.1547-1571.
25. Rolls ET, Deco G, Huang CC, Feng J. (2022). Human Amygdala compared to Orbitofrontal Cortex Connectivity, and Emotion. Prog Neurobiol. Nov 25:102385. doi: 10.1016/j.pneurobio.2022.102385. Epub ahead of print. PMID: 36442728.
26. Rostomyan, Anna (2020). Business Communication Management: The Key to Emotional Intelligence. Hamburg: Tredition.
27. Rostomyan, Anna (2022a). The Ultimate Force of Emotions in Communication: A Linguo-cognitive Analysis of Verbal and Non-verbal Expressions of Emotions (on the material of English). Dissertation (2013). Dueren: Shaker Verlag.

28. Rostomyan, Anna (2022b). Emotional Intelligence as a Keystone towards Success. Moldova: Generis.

29. Russell, J. A. (1980). A circumplex model of affect. Journal of Personality and Social Psychology, 39(6), 1161–1178. http://doi.org/10.1037/h0077714

30. Scherer, K. R. (2005). What are emotions? And how can they be measured? Social Science Information, 44(4), 695–729. http://doi.org/10.1177/0539018405058216

31. Scherer, K. R. (2009). The dynamic architecture of emotion: Evidence for the component process model. Cognition & Emotion, 23(7), pp. 1307–1351. http://doi.org/10.1080/02699930902928969

32. Simonov, P. (1997). Brain mechanisms of emotions. Neuroscience and BehavioralPhysiology, 27(4), pp.405-413.

33. Smith, C. A., & Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. Journal of Personality and Social Psychology, 48(4), 813–838. http://doi.org/10.1037/0022-3514.48.4.813

34. Smith, C. A., & Lazarus, R. S. (1993). Appraisal components, core relational themes, and the emotions. Cognition & Emotion, 7, pp. 112–269.http://doi.org/10.1080/02699939308409189

35. Xia SH, Yu J, Huang X, Sesack SR, Huang YH, Schlüter OM, Cao JL, Dong Y. Cortical and Thalamic Interaction with Amygdala-to-Accumbens Synapses. J Neurosci. 2020 Sep 9;40(37):7119-7132. doi: 10.1523/JNEUROSCI.1121-20.2020. Epub 2020 Aug 6. PMID: 32763909; PMCID: PMC7480237.

36. Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. American Psychologist, 35(2), 151–175. http://doi.org/10.1037/0003-066X.35.2.151

37. Zelenski, J. M. (2019). Positive Psychology: The Science of Well-being. London: Sage.