LVA

Parameters Breakdown

Don’t Estimate, KNOW™

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Introduction

This manual was created to provide developers and product managers a detailed look into the output of the Layered Voice Analysis (LVA™) technology.

The information includes definitions of the various cognitive and emotional parameters and their respective ranges, as well as task-specific concepts and notes.

Essentially, this manual is a bible for developers working on implementing LVA into existing, or brand new applications.
It is highly recommended to refer to this document from the ideation and concept-building stage, and throughout your development project.

Please not that this document is not meant for user-training purposes.
If you require training for professional users and/or investigators - please contact Nemesysco.

Glossary – The Emotion Grid Output

Before diving into the many emotional and cognitive parameters that the LVA technology can extract from the human voice, let's take a quick look at a few core concepts and key definitions that will be used along the way:

- **Objective parameters –** Basic emotion values that are calculated and normalized to scale and are relative to known standard ranges of the global population.

- **Calculated objective parameters –** Complex Emotional values that are comprised of several combinations of the 'Objective parameters'.

- **Calibration process –** The initial analysis process where the analyzed individual's state of homeostasis (baseline) is determined. In real-time analysis cases, calibration is performed during the first 8-12 seconds of the audio session. In offline analysis (analysis of voice recordings) calibration is achieved by scanning the entire set of available voice data.
  The calibration line includes 3 dimensions of data per calculated emotional vector - stability, range and averages.

- **Subjective parameters –** Basic emotion values that are calculated as deviations from the analyzed individual's baseline state ('calibration' values).

- **Risk –** A consolidated metric showing the level of disturbance that the speaker experiences in multiple emotional vectors simultaneously. Risk values can be highly indicative of the speaker's level of honesty related to specific statements.

- **Research Parameters-** An extended set of biomarker-based parameters that have yet to be fully researched by Nemesysco, and that are provided as-is and without specific recommendations. Research parameters are provided as a means to enhance your applications with additional analytical capabilities and emotional data.
  Please note that it is advised to evaluate the applicability of these parameters to your application's real-life use-cases, and to establish the standard ranges that your application is expected to operate in.

- **Segment -** A segment is a logical block of speech, containing a word or a part of a sentence. A segment's length can range from 0.4 seconds and up to 3 seconds maximum. The length is determined according to user-defined preferences and the system's internal logic.

- **Emotional Diamond -** An intuitive visual representation of eight emotional states and their respective intensity. Each emotion is represented as a dynamic "arm" that extends when emotions intensify, and retracts when values are back to normal or lower, - making it easy to visualize the dominant emotion at any given moment . The values are normalized based on the prevalence of these emotional states (normal-distribution) within the population.

- **Segment EDP –** These parameters are used to generate the Emotional Diamond or an equivalent visualization while a conversation plays. The segment EDP values are normalized according to a pre-defined business logic and made to present values reflecting normal distribution from 1-100.

The LVA parameters – Description & ranges

The following series of tables provides a thorough description of the LVA parameters, detailing the cognitive and emotional states they measure, as well as the ranges per emotional state (where applicable).

2. SUMMARY PARAMETERS

Summary parameters are the output data generated at the end of a real-time analysis session, or after an analysis of an audio file ('Offline analysis') has concluded.
Summary parameters include sets dedicated to emotions, mood, risk, and parameters pertaining to the Emotional Diamond concept.

2.1 Risk Summary

Parameter	Description	Range
Channel	Indicates if the analysis data is for the left or right audio channel (stereo files only).	0/1
Segments	Shows the number of segments captured (per channel).	Counter
AverageOverallRisk	A risk score indicating the probability and prevalence of inaccurate or untrue statements. This parameter is a consolidated calculation of the average risk per the relevant voice sample. A sample may be a full analysis session or a part of a session.	**Range:** 0-100 **0-20:** No risk . **21-40:** Low risk. **41-60:** Medium risk. **61-80:** High risk. **81-100:** Very high risk.
MaxSOS	Highest levels of SOS ("Say or Stop") per session: SOS measures the level of self-monitoring applied by a speaker wishing to choose their words carefully. Low values indicate minimal self-monitoring, while high values indicates that the speaker is either: 1. Unsure or having regrets about saying something. 2. Keeping a secret about the discussion topic.	**Range:** 30-150 **30-60:** Extremely low. **60-70:** Low. **70-90:** Normal range, normal self-monitoring. **90-110:** Normal range, high self-monitoring. **Above110:** abnormally high self-

		monitoring levels.
SuspectedRiskCounter	A counter of suspected risk segments detected throughout the session. A 'suspected risk' segment is a segment in which the risk assessment engines detected a level of risk that raises initial suspicion.	Counter It is advised to examine every suspected segment by correlating the indicated risk with the content and context of the statements.
MidRiskCounter	A counter of medium risk segments detected throughout the session. A 'medium risk' segment is a segment in which the risk assessment engines detected a moderate level of risk and/or a somewhat inaccurate statement.	Counter It is advised to examine every medium risk segment by correlating the indicated risk with the content and context of the statements.
MidhighRiskCounter	Counter of medium-high risk segments detected throughout the session. A 'medium high risk' segment is a segment in which the risk assessment engines detected higher risk levels, mostly indicative of inaccurate statements.	Counter It is advised to examine every med-high risk segment by correlating the indicated risk with the content and context of the statements.
HighRiskCounter	A Counter of high-risk segments detected throughout the session. A 'high risk' segment is a segment in which the risk assessment engines detected a very high level of risk and suspect the related statement/s to be untrue.	Counter It is highly advised to examine every high-risk segment by correlating the indicated risk with the content and context of the statements.
OZ3	**Research parameter** A value indicative of multiple deviations from the emotional norm (homeostasis). *Mainly for research purposes	**Range:** 0-5000 Higher values indicate higher internal reaction in multiple emotional parameters

2.2 Emotional Summary

Parameter	Description	Range
Channel	Indicates if the analysis data is for the left or right audio channel (stereo files only).	0/1
Segments	Shows the number of segments captured (per channel).	Counter
CallTag	A call classification tag consolidating the dominant values detected in the call (per	**Call Tags include:** •Normal Call

	each of the two channels) to determine the call's type.	•Stress Call •Energy Irregularity •Dissatisfaction •Aggressive Call •Tone Priority •Mid Priority •High Tone Priority •High Priority (*Please find description of the Call Tags here)
AverageStress	The average value of *objective* stress detected throughout the session. Please note: Due to the average calculation, at times even minor deviations can be meaningful and may require attention.	**Range:** 0-30 **0-10:** Expected values. **Note:** Normal levels may vary depending on the use-case and should be defined accordingly. For example, stress levels of callers contacting emergency services are likely to be much higher, on average, than stress levels of callers contacting retail services.
AverageEmotionalLevel	The average value of 'EmotionalLevel' 'EmotionLevel is an indication of increased energy and excitement. A speaker's emotion level can be compared with their level logical activity to determine if a person is more emotionally or logically driven. Please note: Due to the average calculation, at times even minor deviations can be meaningful and worth alerting or otherwise bringing them to the attention of the end-users.	**Range:** 0-3 **14-16:** Expected values. **Below 14:** low level of emotional reaction. **Above16:** elevated emotional reaction.
AverageCognitiveStressLevel	The average value of 'CognitiveStressLevel'. Cognitive Stress levels indicate whether the speaker experience internal conflict about the topic/statement or speaking with confidence. Please note: Due to the average calculation, at times even minor deviations can be meaningful and worth alerting or otherwise bringing them to the attention of the end-users.	**Range:** 0-30 **14-16:** Expected values. **Below 14:** low level of internal conflict, higher confidence. **Above 16:** High level of internal conflict, lower confidence.

AverageEnergy	The average value of objective energy level. Speaker energy levels can indicate many related states, from tiredness and lack of interest to tension and aggression. Please note: Due to the average calculation, at times even minor deviations can be meaningful and worth alerting or otherwise bringing them to the attention of the end-users.	**Range:** 0-30 **0:** Fatigue. **1-3**: Very low. **4-7:** Male norm range. **4-9:** Female norm range. **Above 9:** High. **Above 15:** Requires attention. Usually refers to high tension, anger or aggressiveness.
AverageUneasiness	The average value of objective uneasiness level. Please note: Due to the average calculation, at times even minor deviations can be meaningful and worth alerting or otherwise bringing them to the attention of the end-users.	**Range:** 0-30 **0:** No uneasiness or embarrassment detected. **1-2:** Normal values. **Above 2**: High levels of uneasiness or embarrassment detected. Attention required.
CLStress	Summarizes the general stress level behavior and indicates the recovery ability from stressful events.	**Range:** (-1) - 7 **(-1)**: Detection failed. **1:** No stress detected. **2:** Low stress, good recovery. **3:** Medium stress, good recovery. **4:** High stress, good recovery. **5:** High stress, difficult to recover. **6:** High stress with no recovery. **7**: Extreme stress levels, requires attention. may be harmful if not tended to.
MentalEfficiency	Measures fluctuations in mental effort (from high to low) during the session. Indicative of the efficiency of the thinking process. In agent-client interactions in contact centers, high levels may indicate stress, lack of genuine engagement with the client, and a need for more training. **Should be read together with the MentalEffort value.**	**Range:** 1-8 **1-2**: Low. **3-5**: Normal. **6:** High. **7:** Very high.. **8:** Extremely high.

MentalEffort	The average mental effort detected during the session. Indicative of the thinking challenge level. **Should be read together with the MentalEfficiency value.**	**Range:** 1-7 **1:** extremely low effort. **2:** low effort. **3:** normal-low effort. **4:** normal. **5:** normal-high. **6:** high effort. **7:** extreme effort.
Anger	The average of the 'anger' parameter detected throughout the session.	**Range:** 0-30 **Desired values:** **0-1** (no anger or very low anger detected). Every value above 1 requires further examination.
Arousal	The average of the 'arousal' parameter detected throughout the session. Arousal indicates a profound interest in the conversation topic (positive or negative).	**Range:** 0-30 **0-5:** Expected value (No arousal to low arousal). Values above 5 indicate higher levels of arousal than the norm.
Sadness	The average of the 'sadness' parameter detected throughout the session.	**Range:** 0-30 Norms may vary based on the nature of the sessions.
Atmosphere	An indication of the general positive/negative mood tendency.	**Range:** (-30) - 30 0 - No significant positive or negative emotions detected. Positive values - indicate a positive tone. Negative values - indicate a negative mood.

3 *CallTag classifications

CallTags are used to classify calls with 8 distinct classifications.
These classifications are derived from the prevalence and values of the emotions detected throughout a call. In turn, these classifications can help stakeholders gain a clear overview of the types of calls that took place, and alert stakeholders about negative calls that require attention.

Normal Call – No significant emotional indications were detected during the call, and/or the detected reactions were below the defined thresholds.

Stress Call - High levels of stress were detected in significant parts of the call.

Energy Irregularity - The energy level detected in the call was higher than expected and may be attributed to high arousal or some level of aggression.

Dissatisfaction - The system detected high levels of dissatisfaction in a significant part of the call.

Aggressive Call - The system detected high levels of aggression/anger in a significant part of the call.

Tone Priority – The system detected high tones of voice and possible shouting.

Mid-Priority – Negative emotions (stress, sadness, or aggression) were detected in the call at a prevalence that caused the system to raise an alarm.

High Priority - The system detected high and constant negative emotions, (stress, sadness and/or aggression) at a level that the system recommends the immediate attention of a manager.

3.1 Emotional Diamond Summary

Parameter	Description	Range
Channel	Indicates if the analysis data is for the left or right audio channel (stereo files only).	0/1
Segments	Shows the number of segments captured (per channel).	Counter
Energy	Indicates the energy levels of the speaker (Engaging, forward moving energy).	**Range:** 0-100 Higher values indicate higher emotional energy and in very high levels may indicate either joy or aggression.
Arousal	Indicates a profound interest in the conversation topic or arousal towards the conversation partner.	**Range:** 0-100 Higher values indicate a greater level of passion for the topic or towards the conversation

		partner.
Emotional	Indicates the intensity of the emotional & excitement responses throughout the call.	**Range:** 0-100 Higher values indicate intensely excited reactions.
Uneasiness	Indicates how emotionally uncomfortable and/or embarrassed the speaker is.	**Range:** 0-100 Higher values indicate a greater embarrassment and emotional discomfort.
Stress	Indicates how nervous or concerned the speaker is.	**Range:** 0-100 Higher values indicate a greater concern and higher stress.
Thinking	Indicates how intensively the speaker is thinking while speaking, as opposed to an effortless conversation.	**Range:** 0-100 Low values indicate a well-prepared speaker that doesn't think about what is being said. High values may indicate efforts to imagine or actively invent the story as it develops.
Confidence	Indicates the speaker's level of certainty about what they said.	**Range:** 0-100 Higher values indicate a greater confidence, while low values indicate an internal conflict and lack of certainty.
Concentration	Indicates how focused and/or involved in the topic the speaker is.	**Range:** 0-100 Higher values indicate a greater degree of concentration.
Anticipation	Indicates the speaker's level of expectation for something to happen, and/or for the response of the listener or conversation partner. Depending on the context and recurrence, Anticipation may indicate interest and engagement in the interaction, or the speaker's attempt to elicit a desired response by means of conscious manipulation.	**Range:** 0-100 Higher values indicate a greater level of expectation.
Hesitation	Indicates how careful and self-controlled or freely speaking the speaker was during the conversation.	**Range:** 0-100 **Higher values** (above 70) indicate a significant carefulness and hesitation about what should and should not be said. **Low values** (below 30) indicate

		careless speaking.
CoreType	Basic emotional style calculations. See detailed Emotional Style section for more information.	•EN-LO (Energetic-Logical) •EN-EM (Energetic-Emotional) •ST-EM (Stressed-Emotional) •ST-LO (Stressed-Logical)

3.2 Mood Summary

Parameter	Description	Range
Channel	Indicates if the analysis data is for the left or right audio channel (stereo files only).	0/1
Segments	Shows the number of segments captured (per channel).	counter
CLStress	Summarizes the general stress level behavior and indicates the ability to recover from stressful events.	**Range:** (-1) - 7 **(-1):** Detection failed. **1:** No stress detected. **2:** Low stress, good recovery. **3:** Medium stress, good recovery. **4:** High stress, good recovery. **5:** High stress, difficult to recover. **6:** High stress with no recovery. **7:** Extreme stress readings, requires attention. Might be harmful if not treated.
GeneralMood	Measures whether the overall session contains more positive emotions or negative emotions.	**Range:** (-1) - 2 **(-1):** Negative. **0:** No significant mood. **1:** Positive. **2:** Argumentative.
Confidence	An indicator of the confidence level (level of certainty about what was said) detected throughout the session.	**Range:** (-1) - 2 **(-1):** Low **0:** Normal.

		1: High. **2:** Very high.
Stress	An indicator of the stress level detected throughout the session.	**Range:** (-1) - 2 **(-1)**: Low. **0:** Normal. **1:** High. **2:** Very high.
MentalLoad	An Indicator of the OCA ('Overall Cognitive Activity') parameter detected throughout the session.	**Range:** (-1) - 2 **(-1):** Low. **0:** Normal. **1:** High. **2:** Very high.
MentalEnergy	An indicator of the energy level detected in the entire session.	**Range:** (-1) - 2 **(-1):** Low. **0:** Normal. **1:** High. **2:** Very high.
TopicStressReport	An indicator of stress levels detected in the selected conversation portion, normalized to a scale of 1-5.	**Range:** (-1) - 5 **(-1):** Analysis failed **1:** Low. **3:** High. **5:** Extreme.

3. SEGMENTS PARAMETERS

3.1 Technical and general Parameters

Parameter	Description
SegmentID	The number assigned to a voice segment in the specific channel.
Channel	Indicates if the analysis data is for the left or right audio channel (stereo files only).
StartPos	A segment's start position in seconds. (For example, 540 is 5 seconds and 40/100 of the second).

EndPos	A segment's end position in seconds. (For example, 780 Is 7 seconds and 80/100 of the second).
OnlineLVA	LVA's real-time analysis code of the segment (see LVA code mapping table).
OfflineLVA	LVA's post-processing (offline) analysis of the segment (see LVA code mapping table).
MaxAmp	The highest level of amplitude detected in the voice segment.
AvgAmp	The average amplitude detected in the voice segment.

3.2 Objective Parameters

Parameter	Description	Range
Energy	Indicates whether the speaker has high or low energy levels.	**Range:** 0-50 **0:** Suspected fatigue. **1-4:** Sad or tired. **5-9:** Comfortable. **Above 9:** Highly energetic.
Happiness	Indicates how pleased or happy the speaker is. *Happiness may appear during aggressive argument.	**Range:** 0-30 Any value above zero (0) indicates traces of this emotional state.
Sadness	Indicates how displeased or sad the speaker is.	**Range:** 0-30 Any value above zero (0) indicates traces of this emotional state.
Anger	Indicates how angry or aggressive the speaker is.	**Range**: 0-30 Any value above zero (0) indicates traces of this emotional state.
Stress	Indicates how nervous or concerned the speaker is.	**Range:** 0-30 **0-10:** Normal stress levels. **11-20:** Notable stress.

		21-30: Relatively high. *Spikes of stress are common . Please compare with CLStress to determine overall stress level and possible danger to the speaker.
CognitiveStress	Indicates how uncertain or confident the speaker is about what was said.	**Range:** 0-30 **15:** Normal. **Above 15:** Higher values indicate uncertainty. **Under 15:** Lower values indicate confidence.
Concentration	Indicates how focused and/or involved in the topic the speaker is.	**Range:** 0-30 **0-10:** Normal range. **11-20:** Higher than the norm. **Above 20:** Very high.
Anticipation	Indicates the speaker's level of expectation for something to happen, and/or for the response of the listener or conversation partner. Depending on the context and recurrence, Anticipation may indicate interest and engagement in the interaction, or the speaker's attempt to elicit a desired response by means of conscious manipulation.	**Range:**: 0-30 **0:** Baseline – no Anticipation. **1-10:** Normal range. **11-20:** Higher than the norm. **Above 20:** Very high.
Hesitation	Indicates how careful and self-controlled – or freely speaking the speaker was when making the statement.	**Range:** 0-30 **15:** Normal. **Above 15:** Higher values indicate increased hesitation and self-monitoring (self-censorship). **Above 25:** Extreme hesitation. **Below 15:** Lower values indicate free speech and less self-monitoring. **Below 5:** Extremely low self-monitoring.
IntensiveThinking	Indicates how intensively the speaker is thinking while speaking, as opposed to an effortless	**Range:** 0-30 **0-10:** Normal.

	conversation.	**11-20:** High. **21-30:** Very high.
Imagination	Indicates how intense the cognitive activity of the speaker is in terms of recalling information from memory or visualizing something.	**Range:** 0-30 **0-10:** Normal. **11-20:** High. **21-30:** Very high.
Arousal	Indicates a profound interest in the conversation topic or arousal towards the conversation partner..	**Range:** 0-30 **0-10:** Normal. **11-20:** High. **21-30:** Very high.
Embarrassment	Indicates how embarrassed the speaker is.	**Range:** 0-30 **0:** Normal * Higher values indicate more embarrassment

3.3 Calculated Objective Parameters

Parameter	Description	Range
EmoBalance	The ratio between excitement and energy. * The parameter is mainly intended for research purposes.	N/A
OCA	'Overall Cognitive Activity' – A summary of both emotional and logical processes in the brain. * The parameter is mainly intended for research purposes	**Range:** Not limited **Below 400:** Low . **400-800:** Normal. **801-1200:** High . **Above 1200**: Extreme high.
EmoCogRatio	Indicates rationality of the subject i.e. to what extent the subject is driven by emotions or logic.	**Range:** 30-300 **80-120:** A balanced state between emotions and logic. **Under 80:** An inclination towards the logical mode. **Above 120:** An inclination

		towards the emotional mode.
ExtremeEmotion	Indicates extreme emotional activity overall.	**Range:** 0-30 Higher values indicate a acute emotional distress.
CogHighLowBalance	The balance between high and low cognitive activity bio-markers. * The parameter is mainly intended for research purposes	**Range:** 0-5000 **80-120:** Normal. **Above 130:** Significant difference.

3.4 Subjective Parameters

Parameter	Description	Range
LVAGlobalStress	The normalized Stress level difference in percentage, between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state).	**Range:** 30-300 **80-120**: Normal. **Above 150** - Considered high stress.
LVAEmotionStress	The normalized Emotional level difference in percentage, between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state).	**Range:** 30-300 **80-120**: Normal. **Above 150:** Considered high excitement.
LVACognitiveStress	The normalized conflict level in percentage, between the readings of the current voice segment and the speaker's baseline state. Cognitive Stress is defined as two or more conflicting mental processes that indicate uncertainty.	**Range:** 30-300 **80-120:** Normal. **Above 130:** Indicates uncertainty.
LVAEnergyStress	The Energy level difference in percentage between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state).	**Range:** 30-300 **80-120**: Normal **Above 150:** considered as a noteworthy increase in energy levels.
LVAThinkingStress	Thinking effort level difference in percentage between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state).	**Range:** 30-300 **80-120**: Normal. **Above 130**: Significant difference.

LVAHesitationStress	Hesitation level difference in percentage between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state).	**Range:** 30-300 **80-120:** Normal **Above 130:** Significant difference.
LVARiskStress	Overall difference of the entire emotional state in percentage between the current voice segment readings and the homeostasis state of the speaker (the baseline emotional state). 'Overall difference' indicates a significance departure from a speaker's baseline in multiple emotional parameters.	**Range:** 30-300 **100 :**Normal **120-160:** Departure from the baseline of several parameters that indicates a high probability of inaccurate statement. **Above 160 :**High probability of untrue and high-risk statement.

3.5 Risk Parameters

Parameter	Description	Range
ObjectiveRisk	The objective risk evaluation score, based on the OZ values. The objective risk is comparing multiple emotional variables to the normal distribution of these variables across the global database. High values indicate high risk.	**Range:** 0-360 **0-40**: Low risk. **41-60**: Medium risk. **61-100**: High risk. **100 + *** * The formula calculating Objective Risk uses values greater than 100 in order to ensure that extreme cases stand out and are not diluted by calculation of averages. However, values greater that 100 can be reset to100 according to your own business logic.
OZ1	One of the statistical objective l risk assessment indicators. OZ1 and OZ2 are raw components of 'ObjectiveRisk' and are calculated independently so that they can be validated against each other.	**Range:** 0-4 **0-1**: Low risk. **2:** Medium risk . **3-4:** High risk.

OZ2	One of the statistical objective I risk assessment indicators OZ1 and OZ2 are raw components of 'ObjectiveRisk' and are calculated independently so that they can be validated against each other.	**Range:** 0-4 **0-1**: Low risk . **2:** Medium risk . **3-4:** High risk.
SubjectiveRisk	The overall difference (described in percentage) between the current voice segment readings and the unique calibration baseline of the speaker. This value is based on the LVA Risk Level, normalized to a 0-100 scale.	**Range:** 0-100 **0-40:** Low risk. **40-60:** Medium risk . **Above 60:** High risk.
CombinedRisk	The overall risk level. A combined risk measurement of the subjective and objective risk detected.	**Range:** 0-100 **0-50:** Low risk. **51-80:** Medium risk. **Above 80:** High risk.

3.6 Segment EDP (Real-time Emotional Diamond scale)

Parameter	Description	Range
EnergyEDP	Indicates the energy levels of the speaker.	**Range:** 0-100 Higher values indicate higher emotional energy and in very high levels may indicate joy or aggression.
ArousalEDP	Indicates a profound interest in the conversation topic or arousal towards the conversation partner.	**Range:** 0-100 Higher values indicate a greater level of passion towards the topic or towards the conversation partner
EmotionEDP	Indicates how positively or negatively excited the speaker is.	**Range:** 0-100 Higher values indicate a highly excited reaction.
UneasinessEDP	Indicates how uncomfortable the	**Range:** 0-100

	speaker is.	Higher values indicate a greater embarrassment and emotional discomfort
StressEDP	Indicates how nervous or concerned the speaker is.	**Range:** 0-100 Higher values indicate a greater concern and higher stress.
ThinkingEDP	Indicates how intensively the speaker is thinking while speaking.	**Range:** 0-100 Low values indicate a well-prepared speaker that doesn't think about what is being said. High values may indicate efforts to imagine or actively invent the story as it develops.
ConfidenceEDP	Indicates the speaker's level of certainty about what they said.	**Range:** 0-100 Higher values indicate a greater confidence, while low values indicate an internal conflict and lack of certainty.
ConcentrationEDP	Indicates how focused and/or involved in the topic the speaker is.	**Range:** 0-100 Higher values indicate a greater degree of concentration.

4. The Emotional Diamond – concept & principles

The emotional diamond is a dynamic graphical representation showing the emotional complexity of every speaker in a positive and intuitive manner that can be displayed as a snapshot or as responsive real-time element.
The emotional state is revealed via 8 key emotions:

Energy: Energy is a forward moving power.
Low values indicate tiredness, possible boredom, and the lack of desire to push forward. High values indicate a state of forward movement, either aggressive or happy, but certainly with a strong desire to engage. Energy is calculated from the Energy values of the main emotional readings.

Passion: A forward moving state, stemming from a deep and profound emotional reaction. Normally, we see increased "Passion" when arousal towards a person or an exciting topic occurs. If the arousal or passion is detected for no particular reason, it can indicate a person with high affection and care for others.

Emotional: Emotion is another indication of higher levels of energy and excitement. Every person has a certain degree of emotional activity, and it can be compared and balanced with the logical activity to determine if a person is more emotionally or logically driven.

Uneasy: Appears when the speaker is embarrassed or irritated and is uncomfortable (emotionally speaking) to say the things he said or the be in the situation.

Stress: Stress is defined as the body's reaction to a threat and the desire to retreat. The detected level of stress is indicative of the level of fear the speaker feels in the situation. It should not be immediately associated with "lies", as may be assumed – as it may simply indicate that the speaker prefers to be somewhere else in order to avoid the stressful experience.

Thoughtful: An indicator of the intensity of mental efforts. High values indicate that the speaker is challenged with the answer and is giving it considerable thought. Low values show that the speaker is either well-prepared or uses very light thinking before speaking. This value is NOT indicative of the speaker's I.Q or intelligence level.

Confidence: In the spirit of the Emotional Diamond, Confidence is the opposite value of Uncertainty. Low levels of Confidence imply uncertainty, while high levels indicate reduced inner-questioning and high certainty. These readings are based on the main logical biomarkers and can also show balance, or lack thereof, between logical and emotional activities.

Concentration: Shows how important the discussion topic is to the speaker. If the overall Concertation level is high, the speaker is likely to be very dedicated to their mission, and very precise in their words. Normally, Concentration stands in contrast to the readings of "Uneasy."

* If you choose to show the Emotional Diamond in real-time, it is recommended to show it only for brief periods or when one of the parameters exceeds the value of 70.

5. OnlineLVA and OfflineLVA mapping table

5.1 Online Vs. Offline analysis in LVA7

LVA7's online analysis is designed for on-going, real-time analysis, assisting investigators to adapt their approach and focal points while an interview is in progress. For this reason, the analysis must be based on the baselines calculated during the initial part of the interaction and compared with the on-going emotional responses to the then current baseline.
During real-time investigations it is expected that the investigator remains focused on the speaker, and therefore the LVA sensitivity is reduced to show significant indications only. In post-processing (Offline mode) the investigator is expected to

have more time and ability to examine and compare more reactions, and so the offline analysis is typically more sensitive and detailed.

In LVA7, offline analysis can be performed immediately following an online session, or from a recorded file. When analysis is performed on a previously analyzed online session, the exact same segments and the detected emotional parameters are used for re-evaluation by the Subjective Analysis engine of LVA7, and the stress level indicators are updated using the new baseline (calibration) data.
For more information about baseline calibration please refer to the glossary.

An automated and rapid online to offline analysis is possible as the recorded session was executed in a known situation that are typically the same, the audio was processed from original source and was captured before any compression and de-compression, and the segmentation was already assumed to be properly done.

When processing standalone recorded files, the system designer should be prepared for diverse scenarios as well as different conditions while capturing the audio - varied background noises, varied audio qualities and diverse emotional structures.
Similarly, the application's desired output should be taken into account, i.e., what is the goal of the application? Risk assessment? Personality traits? emotions per segment?
Handling these scenarios will require adaptive background noise level detection, segment display and editing abilities, splitting and merging segments abilities, and other manual and automatic voice processing technologies and techniques.

5.2 Segment LVA analysis

The segment data contains 2 columns of textual responses, stating the highest (or most relevant) indication to be displayed per segment. See the possible responses in the table below (based on the message code that appears in the brackets next to the textual one):

Code (MsgX)	Textual message	definition
-3	**Bad Cal. Segment**	Indicates that the segment analysis is suspected to be flawed and the system did not use it for the initial calibration process.
-2	**Calibrating…**	Indicates that the segment's data is within the acceptable ranges and the system used it for the initial calibration process. This message applies only in the Online section.
-1	**Calibration ended**	The baseline calibration has been completed successfully in this segment. Real-time analysis is active.
0	**LOW RISK (or Truth)**	The system did not detect any red flags in this statement. The statement is likely truthful.
1	**HIGH ANTICIPATION**	A High level of interest was detected.
2	**EXCITEMENT**	A higher-than-normal excitement level was detected.
3	**UNEASY**	Embarrassment or uneasiness were detected.

4	**SUBJECT NOT SURE**	The speaker is not confident in his answer.
5	**STRESS**	A higher-than-normal stress reaction was detected.
6	**HIGH ENERGY**	A higher-than-normal energetic state (may be indicative of rising aggression).
7	**HIGH_CONCENTRATION**	The system detected high levels of concentration, indicating the statement is important to the speaker.
8	**HIGH_EXCITEMENT**	A high level of excitement was detected.
9	**HIGH_STRESS**	A high level of stress was detected.
10	**VOICE_MANIPULATION**	The system suspects the tested party is deliberately controlling their voice to sound different than their internal experience.
11	**EXTREME_STRESS**	An extreme state of stress was detected.
12	**EXTREME_EMOTIONNEGATIVE**	An extreme state of negative emotion was detected.
13	**EXTREME_EMOTION**	An extreme state of excitement was detected.
14	**LVA_EXTREME_COG**	An extreme state of conflict (cognitive stress) was detected.
15	**LVA_EXTREME_CONCENTRATION**	Extreme concentration levels were detected; this point is highly important to the speaker.
16	**STRESS RELIEF**	The system detected a sudden drop of stress.
17	**SUSPECTED**	First level of "risk" indications – the system senses something is wrong.

6. Emotional Styles

Repeating emotional indicators around specific topics were found to reveal emotional styles and behavioral tendencies that can deliver meaningful insights about the speaker.

We have found correlations between the poles of the Emotional Diamond and several types of commonly used personality assessment systems around the BIG5 classifications.

These are identified in the Emotional Diamond poles:

Nemesysco's coding	Emotional style	General classification
EN-LO	Energetic-Logical	Fast paced and outspoken, focused and confident.
EN-EM	Energetic-Emotional	Innovator, passionate leader, a people's person.
ST-EM	Stressful-Emotional	Accepting and warm, cautious and defensive at times.
ST-LO	Stressful-Logical	Confident and logic-driven, intensive thinker and protective.

7. LVA theory and types of lies

The LVA theory recognizes 6 types of lies differing one from the other by the motivation behind them and the emotional states that accompany the situation:

1. **Offensive lies** – Lies made to gain profit/advantage that would otherwise not be received.
2. **Defensive lies** – Lies told to protect the liar from harm, normally in stressful situations, for example when confronting the authorities.
3. **"White lies"** – An intentional lie, with no intention to harm - or no harmful consequences, nor self-jeopardy to the liar.
4. **"Embarrassment lies"** – Told to avoid temporary embarrassment, normally with no long-term effect.
5. **"Convenience lies"** - Told to simplify a more complicated truth and are normally told with the intention to ease the description of the situation.
6. **Jokes** – an untruth, told to entertain, with no jeopardy or consequences attached.

8. The "Deception Patterns"

The Deception Patterns are 9 known emotional structures associated with different deceptive motivations that typically have a higher probability of containing deception. The Deception Patterns are used for deeper analysis in the Offline Mode. Using the Deception Patterns requires a good understanding of the situation in which the test is taken, as some deception patterns only apply to certain situations.

The following list explains the various Deception Patterns and the meanings associated with each of them:

Global Deception Patterns - (Deception analysis without a 'Pn' symbol)

Global deception patterns reflect a situation in which two algorithms detected a statistically high probability of a lie, coupled with an extreme lie stress. This default deception pattern is LVA7's basic deception detection engine, as such, it is always active, regardless of mode or user's preferences.

Deception Pattern # 1 – "Offensive lies"

This pattern indicates a psychological condition in which **extreme tension and concentration** are present. treat this pattern as a high risk of deception when talking to a subject who might be an offensive liar for determining a subject's involvement or knowledge about a particular issue. This deception pattern can also be used when the subject feels that they are not in jeopardy. When using the P.O.T. (explain)Investigation technique this is likely to be the case that indicates deception together with the "high anticipation" analysis.

Deception Pattern # 2 – "Deceptive Circuit" lies

A psychological condition in which **extreme logical conflict and excitement** indicate a probable deception. Treat this pattern as a high risk of deception in a non-scripted conversation, in which a subject is feeling abnormal levels of excitement and extreme logical or cognitive stress.

Deception Pattern # 3 – "Extreme fear" lies

A psychological condition in which extreme levels of stress and high SOS ("Say or Stop") are present. Treat this pattern as a high risk of deception **only** for direct responses such as - "No, I did not take the bag." If you detect deception using this pattern, this is a serious warning of the general integrity of the tested party.

Deception Pattern # 4 – "Embarrassment lies"

Pay attention to this indication only if you feel the subject is not expected to feel embarrassed by the nature of the conversation.
Usually, it applies to non-scripted conversations.

Differentiate between the relevant issues when using this pattern to gauge situations with high risk of deception. When deception is detected around irrelevant topics, this is likely an indication that the speaker does not wish to talk about something or is embarrassed, in which case **the deception indication should be ignored**. In relevant cases, try to understand whether the feeling of embarrassment is comprehensible for this specific question or sentence. Because of its dual implication, Pattern # 4 is considered less reliable than the others.

Deception Pattern # 5 – "Focus point" lies

This pattern indicates a structure of **extreme alertness and low thinking levels.** With this pattern too, it is important to differentiate between relevant, or hot issues and cold, or non-relevant ones. If Deception Pattern # 5 was found in a relevant segment, this is likely an indication of deception. However, if this deception pattern is found in non-relevant segments, it may be an indication of sarcasm or a spontaneous response. Treat this pattern as high risk of deception only when interrogating a subject within a structured conversation or any time the subject knows this will be the topic or relevant question. **This pattern should not be used for a non-scripted conversation.**

Deception Pattern # 6 – "SOS lies"

This pattern indicates **extremely low alertness and severe conflict about whether to "Say-Or-Stop" (S.O.S.)**.

If you receive an indication of this pattern, it is recommended that you continue investigating this issue in a non-scripted conversation in the Online Mode.

In a relevant issue, you may want to drill-down into the related topic with the analyzed subject, as this could imply evasiveness on their part. If you receive a warning of deception in an irrelevant top, it is up to you to decide whether to continue investigating this topic.. It may reveal an item the subject does not want to discuss. It may, however, be an indication that there is a high level of background noise, or a bad segment contained in the file. It is recommended that you double-check these segments.

Deception Pattern # 7 – "Excitement-based lies"

This pattern indicates **extremely low alertness and very high excitement**. This is an indication that the subject is not accustomed to lying or perhaps just does it for "fun." On the other hand, it might indicate a traumatic experience related to this issue**. Do not use this deception pattern when interrogating a subject about possible traumatic events**.

Treat this pattern as high risk of deception when interviewing a subject suspected to be an offensive liar, when offensive lies are suspected or when using a Pick-of-Tension method for determining a subject's involvement or knowledge of a particular issue. Moreover, this deception pattern can be effective even when the subject feels they are not in jeopardy.

Deception Pattern # 8 – "Self-criticism" lies

This pattern indicates **extremely low alertness and very high conflict.** The subject has a logical problem with their reply. Do not use this pattern with a subject that may be extremely self-criticizing. Repeated conflict about this specific issue may indicate a guilt complex. Here, it is important for you to decide whether you sense that the subject is confused. In case of a "justified" confusion, the P8 results should be ignored. If the subject does not display any confusion, seems confident, expresses themselves clearly and phrasing things with ease, a P8 deception pattern will indicate a high probability of deception.

Deception Pattern # 9 – General extreme case

This pattern indicates **extremely low alertness, high conflict and excitement.** Treat this pattern as a high risk of deception when the subject appears as a normal, average person, i.e. when the other test parameters look fine. The deception pattern itself is very similar to the Global Deception Pattern, and Deception Pattern # 9 is used as backup for borderline cases.