FUZZY LOGIC BASED APPROACH FOR AUTOMATION OF EMOTION DETECTION IN MISOPHONIA

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ABSTRACT

Human being mostly categories into two types, the one who follow distress cycle and other who believe on wellness cycle. Output of distress cycle is decreased productivity, decreased enjoyment and decreased intimacy, whereas output of wellness cycle is increased productivity, increased enjoyment and increased intimacy which is essential for life. Reason of distress could be anything like emotion, disease, environment, family, pain. One of the mostly unexplored areas of cause of distress is misophonia. It is a disorder related to various senses like sound, sight, smell, taste and touch. This disorder is not in DSM-V, underscoring that it is not known by psychiatric and medical communities. We have proposed an automatic fuzzy approach system for identification of intensity of emotions related to various triggers on the basis of age group.

KEYWORDS

Misophonia,Emotion,Misophonia Activation Scale,Trigger

1. INTRODUCTION

What is misophonia? As defined in Sound-Rage. A primer of the psychology and neurobiology of a little known anger disorder, “Misophonia comprises a unique set of symptoms, most likely attributable to neurological causes unrelated to hearing-system dysfunction. It can be described as an immediate and extreme emotional response of anger accompanied by an automatic physiological flight response and a fundamental discomfort to identifiable auditory, visual, and olfactory stimuli. The disorder disrupts daily living and can have a significant impact on all social interactions [1].The Misophonia Activation Scale (MAS-1) is intended to guide clinicians and patients in assessing the severity of a sufferer's condition. It concentrates on physical and emotional reactions to a particular misophonic trigger. It makes little reference to the status of the trigger person, i.e., as a known trigger or otherwise. Someone with misophonia may not necessarily exhibit all, or even many, of these behaviors. Also, some sufferers may experience symptoms in a different order, for instance, engaging in some "confrontational" coping behaviors before adopting more co-operative ones. MAS-1 is a work in progress and may be updated in the light of published research.

Table 1. Misophonia Activation Scale

Level	Response
0	Person with misophonia hears a known trigger **sound** but feels no discomfort.
1	Person with misophonia is aware of the presence of a known trigger **person** but feels no, or minimal, anticipatory anxiety.
2	Known trigger sound elicits minimal psychic discomfort, irritation or annoyance. No symptoms of panic or fight or flight response.
3	Person with misophonia feels increasing levels of psychic discomfort but does not engage in any physical response. Sufferer may be hyper-vigilant to audio-visual stimuli.
4	Person with misophonia engages in a minimal physical response - non-confrontational coping behaviors, such as asking the trigger person to stop making the noise, discreetly covering one ear, or by calmly moving away from the noise. No panic or fight or flight symptoms exhibited.
5	Person with misophonia adopts more confrontational coping mechanisms, such as overtly covering their ears, mimicking the trigger person, engaging in other echolalias, or displaying overt irritation.
6	Person with misophonia experiences substantial psychic discomfort. Symptoms of panic, and a fight or flight response, begin to engage.
7	Person with misophonia experiences substantial psychic discomfort. Increasing use (louder, more frequent) use of confrontational coping mechanisms. There may be unwanted sexual arousal. Sufferer may re-imagine the trigger sound and visual cues over and over again, sometimes for weeks, months or even years after the event.
8	Person with misophonia experiences substantial psychic discomfort. Some violence ideation.
9	Panic/rage reaction in full swing. Conscious decision **not** to use violence on trigger person. Actual flight from vicinity of noise and/or use of physical violence on an inanimate object. Panic, anger or severe irritation may be manifest in sufferer's demeanour.
10	Actual use of physical violence on a person or animal (i.e., a household pet). Violence may be inflicted on self (self-harming).

2. ONLINE SURVEY

On July 8th, 2013, a group of people who suffer from misophonia, self-identified as a “group of amateur researchers,” compiled a survey of just over 120 questions with the hope of generating a data base of information. The survey was publicized to misophonia communities on at least three social media group sites, yahoo groups (Selective Sound Sensitivity Yahoo group), reddit (r/misophonia on reddit), and tumblr (misophoniasupport.tumblr.com). As an online survey with no log-in or opt-in requirements, it was an open survey available to the general public. Thus, for the following analysis, it is assumed that the people who answered the survey are misophonia sufferers.

3. TRAINED DATASET GENERATION ON THE BASIS OF ONLINE SURVEY

We have observed 521 samples, 395 females and 126 males in the age group of 12-50.For better understanding of generation of emotion pattern we have sub-divided age as per following:

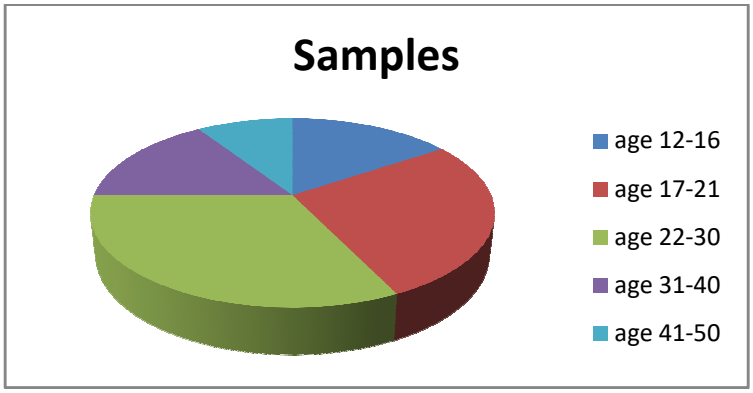
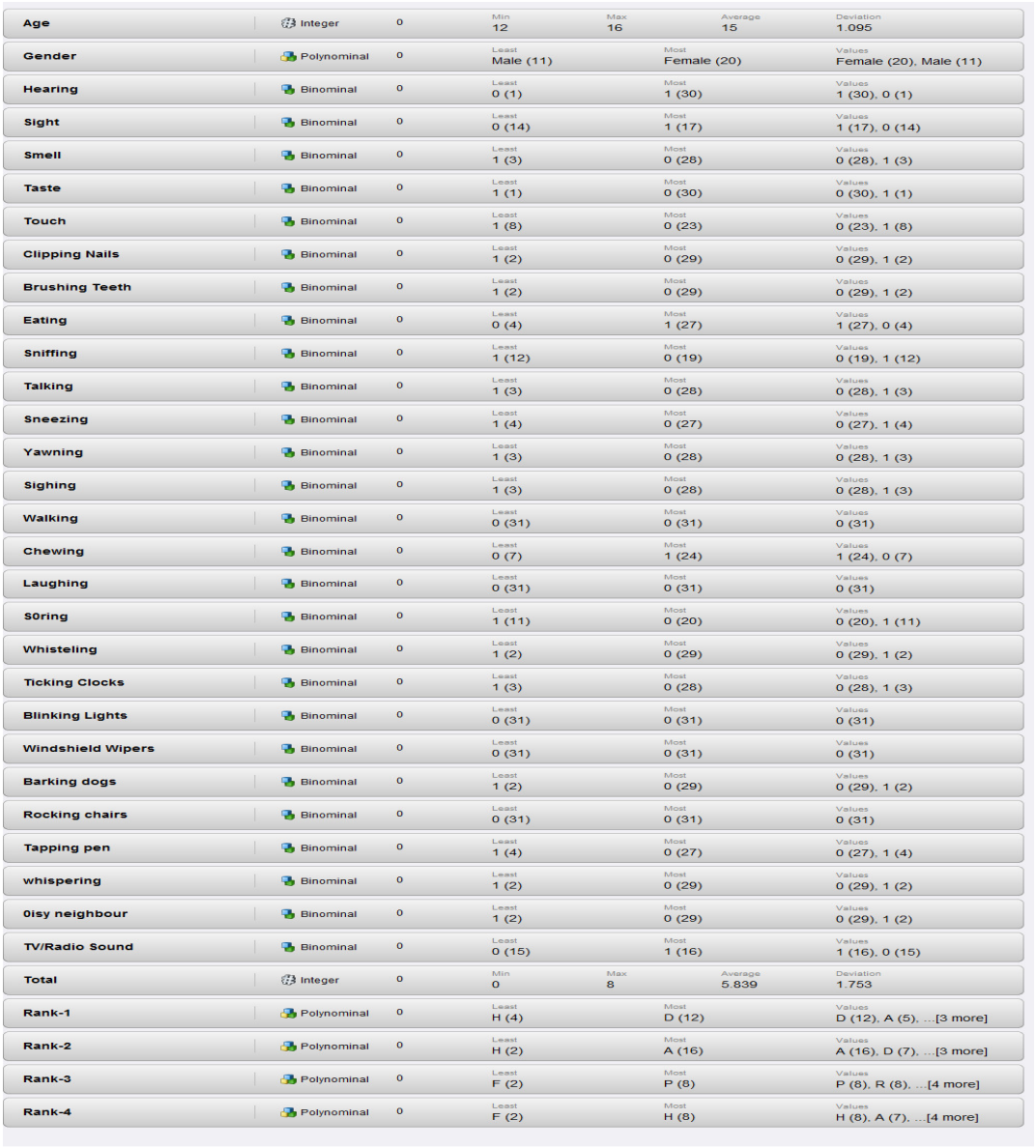


Figure 1. No of samples and age group

Questionnaire asked in an online survey are related to whether emotion get triggered or not, if reply of question is yes we have converted it into 1 and if reply is no we have converted it into 0.Total 27 triggers which are the cause for activation of sound disorder we have included and rest we have ignored. We have used rapid miner for the computation of statistics of dataset.

Triggers at the primary level are hearing, sight, any specific taste, any specific smell or any specific touch. Related to hearing triggers associated are Clipping Nails, Brushing Teeth, Eating with noise, Sniffing, Talking, Sneezing, Yawning, Sighing, Walking, Chewing, Laughing, Snoring, Whisteling, Ticking clocks, Windshield wipers, Barking Dogs, Rocking chairs, Tapping pen,whispering,Noisy Neighbour,TV/Radio, Any specific sound not listed. Related to sight triggers associated are Clipping Nails, Brushingteeth, Eating with noise, Sniffing, Talking, Sneezing,Yawning,Sighing,Walking,Chewing,Laughing,Snoring,Whisteling,Ticking clocks, Windshield wipers, Barking Dogs, Rocking chairs, Tapping pen,whispering,Noisy Neighour,TV/Radio, Blinking Light, Any specific sight not listed.



Age	Integer	0	Min 12	Max 16	Average 15	Deviation 1.095
Gender	Polynominal	0	Least Male (11)	Most Female (20)	Values Female (20), Male (11)	
Hearing	Binominal	0	Least 0 (1)	Most 1 (30)	Values 1 (30), 0 (1)	
Sight	Binominal	0	Least 0 (14)	Most 1 (17)	Values 1 (17), 0 (14)	
Smell	Binominal	0	Least 1 (3)	Most 0 (28)	Values 0 (28), 1 (3)	
Taste	Binominal	0	Least 1 (1)	Most 0 (30)	Values 0 (30), 1 (1)	
Touch	Binominal	0	Least 1 (8)	Most 0 (23)	Values 0 (23), 1 (8)	
Clipping Nails	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
Brushing Teeth	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
Eating	Binominal	0	Least 0 (4)	Most 1 (27)	Values 1 (27), 0 (4)	
Sniffing	Binominal	0	Least 1 (12)	Most 0 (19)	Values 0 (19), 1 (12)	
Talking	Binominal	0	Least 1 (3)	Most 0 (28)	Values 0 (28), 1 (3)	
Sneezing	Binominal	0	Least 1 (4)	Most 0 (27)	Values 0 (27), 1 (4)	
Yawning	Binominal	0	Least 1 (3)	Most 0 (28)	Values 0 (28), 1 (3)	
Sighing	Binominal	0	Least 1 (3)	Most 0 (28)	Values 0 (28), 1 (3)	
Walking	Binominal	0	Least 0 (31)	Most 0 (31)	Values 0 (31)	
Chewing	Binominal	0	Least 0 (7)	Most 1 (24)	Values 1 (24), 0 (7)	
Laughing	Binominal	0	Least 0 (31)	Most 0 (31)	Values 0 (31)	
S0ring	Binominal	0	Least 1 (11)	Most 0 (20)	Values 0 (20), 1 (11)	
Whisteling	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
Ticking Clocks	Binominal	0	Least 1 (3)	Most 0 (28)	Values 0 (28), 1 (3)	
Blinking Lights	Binominal	0	Least 0 (31)	Most 0 (31)	Values 0 (31)	
Windshield Wipers	Binominal	0	Least 0 (31)	Most 0 (31)	Values 0 (31)	
Barking dogs	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
Rocking chairs	Binominal	0	Least 0 (31)	Most 0 (31)	Values 0 (31)	
Tapping pen	Binominal	0	Least 1 (4)	Most 0 (27)	Values 0 (27), 1 (4)	
whispering	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
0isy neighbour	Binominal	0	Least 1 (2)	Most 0 (29)	Values 0 (29), 1 (2)	
TV/Radio Sound	Binominal	0	Least 0 (15)	Most 1 (16)	Values 1 (16), 0 (15)	
Total	Integer	0	Min 0	Max 8	Average 5.839	Deviation 1.753
Rank-1	Polynominal	0	Least H (4)	Most D (12)	Values D (12), A (5), ...[3 more]	
Rank-2	Polynominal	0	Least H (2)	Most A (16)	Values A (16), D (7), ...[3 more]	
Rank-3	Polynominal	0	Least F (2)	Most P (8)	Values P (8), R (8), ...[4 more]	
Rank-4	Polynominal	0	Least F (2)	Most H (8)	Values H (8), A (7), ...[4 more]	

Figure 2. Emotion pattern and triggers

We have sub divided all the samples in the table 1on the basis of triggers responsible for emotion arousal. The minimum number of triggers responsible for generation of emotions lies in the range 0-8, average no of triggers lie in the range of 9-13 and most number of triggers responsible is 14-27.

Table 2.Co-relation of Emotion patterns and No. of triggers

No of Triggers	Age Group	No of samples observed	Most aroused emotion pattern	Least aroused emotion pattern
0-8	12-16	21	DAPH	HHFF
	17-21	48	AAHD	GGFA
	22-30	75	DAHH	GGGF
	31-40	29	AAHR	HHPF
	41-50	18	ARAD	HPRG
9-13	12-16	37	AARH	FFFP
	17-21	58	ARAH	HGGF
	22-30	56	ARHH	GPGF
	31-40	34	RAHH	HHRF
	41-50	19	ADRH	RPPF
14-27	12-16	13	DAAH	PHPR
	17-21	36	ARHH	GGFP
	22-30	37	ADHD	PFGG
	31-40	19	AADH	FGRF
	41-50	11	ADDH	RAPA

3.1. ANALYSIS

From online survey intensity of emotion is directly proportional to age and summation of no of triggers responsible. We have observed generated pattern of an emotions on the basis of level 0-level 4, i.e. rank - 0 to rank - 4. In mostly aroused emotion irrespective of age, disgust and anger are two prominent emotions. From analysis for different age group and different number of triggers, pattern generated is unique. The emotion which is active in mostly aroused pattern is inactive in least aroused pattern and if it is available then it is at the rank-4 not at the prominent position. Prominent emotions are Disgust(D), Anger(A), Panic(P), Hate(H), Rage(R), Fear(F), Guilt(G)

4. RELATED WORK

Prof. L.A.Zadeh has invented the concept of fuzzy logic in 1964 and presented his first paper in 1965 on fuzzy sets. Later Assilian and E.Mamdani developed fuzzy inference approach in 1974, which offers a very reasonable handling of imprecise data and solving of different real world problems using systemic rule dependent concept. Another parallel approach was developed by Sugeno, which is equally popular and used widely as an alternate approach for inferencing. Fuzzy logic has been very widely used in design of decision making systems in wide range of fields, particularly scientific, such as medicine, engineering, social sciences, etc. There have been hybrid systems developed in recent past with techniques of neural networks, neural learning, being utilized in enhancing and fine tuning the decision making ability of fuzzy systems.

The concept of fuzzy logic is very popular in decision areas of computer sciences, especially, where the data is uncertain and unconventional. The uncertain data collected in real time scenarios can be fed into fuzzy logic model to obtain meaningful conclusions which can form a firm base to future work carried out by practitioners of the concerned domain. The choice of

fuzzy logic is due to the reason of its suitability to work with imprecise data. Additionally, it offers easy understanding of the utilized process of reasoning and decision making.

Ashish Patel [2] proposed a self-regulating system by utilizing a self-organizing rule-based fuzzy system. The system having inherent ability to handle the uncertainty and having an add-on mechanism that refuses to work with imperfect data. The system generally asks five symptoms to the user i.e. Daytime symptoms, Night time symptoms, Peak Expiratory Flow rate variability, Saturation of oxygen and peak Expiratory Flow rate and by following fuzzy rules it comes up with one result of the Asthmatic syndrome.

Wang and Palade [3] proposed a system for diagnosing Lung Cancer by utilizing Multi-Objective Evolutionary Algorithm based Interpretable fuzzy. This system analyzes biomedical data-set, i.e. proteomics mass, gene expression and by following fuzzy rules it come up to a conclusion.

Indah Soesanti [4] proposed a system for diagnosing MRI (Magnetic Resonance Imaging) segmentation of brain images by utilizing optimized fuzzy logic. The outcomes of the system shows that the system efficiently segments the normal brain MRI image, brain image MRI with spatial information and the brain image MRI that contained tumor.

Benecchi [5] proposed a system for diagnosing Menigioma by integrating Fuzzy C-Mean with region growing techniques. The outcome of the system shows that the system effectively detects tumors in the images from the patient's images that contained Menigioma.

Samar Samir Mohamed [6] proposed a system for diagnosing meningitis by utilizing fuzzy cognitive map. The outcomes of the system show that the system effectively detects membranes surrounding the brain and spinal cord. Physicians generally used this tool for precise diagnosis.

4.1. PROPOSED WORK

In a real-time scenario, the vagueness and imprecision of a statement can be interpreted through the fuzzy approach. In the present work the data concerning response of the Misophonia sufferers to various triggers under categories of senses, such as, sight, touch, hearing, taste and smell have been collected. This response is further represented in form of pattern of emotions, which are manifested in the misophonia patients. Since this is a pioneering work, with online survey data utilized for generation of the trained data set, the work has been extended to the design and development of an expert system built using fuzzy inference mechanism.

The fuzzy inference expert system has been modeled using fuzzy sets, fuzzy rules, linguistic variables and fuzzy membership functions for input and output. Based on the online survey sample data available, the most probable response of the misophonic individual, in the form of triggered emotional pattern is obtained. The learnings in terms of causal category and the triggers, and resultant emotional pattern have been built into the knowledge-base of the built system, for systematic decision making and recommendation.

The system accepts the input regarding age, trigger category and the specific trigger, and predicts as output the response which is most probable resultant emotional pattern. The system uses fuzzy sets and 'if-then' rules relevant to fuzzy sets, to make decisions about incomplete or vague

information available to it. In this work, the mamdani fuzzy inference algorithm is used to determine the output.

The FIS (Fuzzy Inference System) executes in three major steps- Fuzzification, Inference and Defuzzification. Defuzzification provides the information in terms of crisp values and the same can be used to predict the result.
The first part of the work involves determination of degree of membership for crisp input variables. The next aspect is inferencing, involving evaluation of fuzzy rules and producing of the output for each of the rules. Finally, the resulting fuzzy output is converted back into crisp values through the defuzzification process. The section 4.2 describes the fuzzy system in detail

4.2. DESIGN METHODOLOGY

For a given individual, the basic details such as 'age' and 'name' are accepted by the system, after which it proceeds with the acceptance of fuzzy input values, inferences through its knowledge-base and then presents the output. Five linguistic variables namely, the senses such as sight, hearing, touch, smell and taste have been used as input variables. Each of these variables can be further characterized by specific behavior that is the trigger for influencing the onset of misophonic symptoms, which is actually, the emotional response of the individual, the misophonic sufferer. Therefore, the output parameter is the emotional pattern response. On the basis of input and output variables about 22 fuzzy rules have been defined. Each input has two membership functions and output has fifteen membership functions. The 'flint tool kit' within WinProlog environment has been used to develop the system.

Each of the five linguistic variables is defined by two input membership functions namely, 'yes' and 'no'. The system accepts the values entered by the user for the five senses, indicating whether or not, the specific sense triggers misophonic response in a given person. For the input variables, 'sight' and 'hearing', a positive response, leads to further probing, in terms of the specific behaviors or actions, such as 'clipping nails','windshield wiper movement', that are responsible to trigger misophonic response. The system accepts the input, each time incrementing by one, a counter, named 'score', for every 'yes' input gathered. This is indicative of the severity of misophonia for a given individual, as the larger the score, the more is the intensity of the disorder.

Age of the individual has been taken as another input variable, covering a range of 12 to 50, with five fuzzy sets made for sub-ranges in it. A fuzzy set 'child' has age range of 12 to 16, 'fuzzy set 'teen' has age range of 15 to 21, fuzzy set 'adult' has age range of 20 to 30, fuzzy set 'average' has age range 29 to 40, and fuzzy set 'old' has age range 39 to 50. The age-wise distribution of output provides perspective of specific influence of age of an individual on the response of the individual.

The score ranges have been mapped to emotional response patterns. A fuzzy matrix has been made with age in first and score in second columns respectively, implying the resultant emotional pattern response in the third (output) column. Thus, the system accepts the details, executes the fuzzy rules and displays the emotional response pattern, as a recommendation.

The proposed system facilitates the misophonia interest groups, medical practitioners, social workers, and even misophonia sufferers themselves to identify, understand, investigate and remediate the disorder.

The section below presents a sample of source code depicting design of fuzzy sets, input and output variables, membership functions and fuzzy rules.

The source code of the proposed system is included in Annexure 1, appended at the end of this paper.

The implementation of the proposed system elucidating work flow has been detailed in the section below.

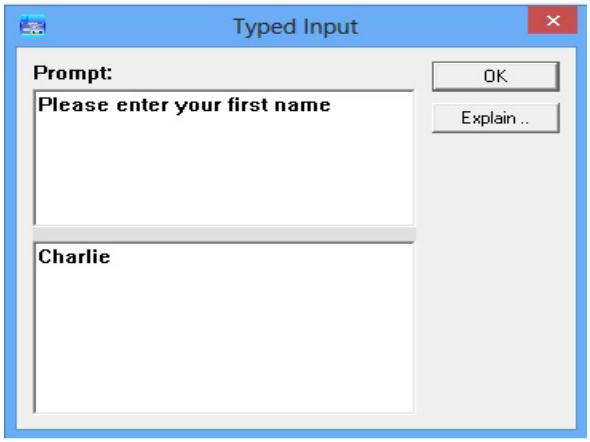


Figure 3. Requesting input (Name)

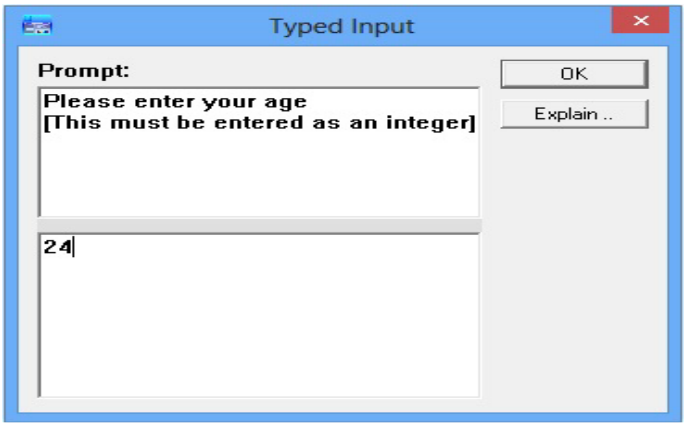


Figure 4. Requesting input (Age)

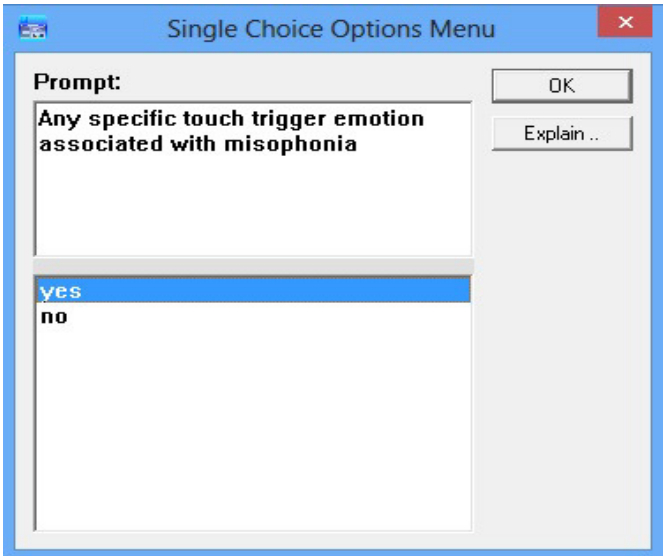


Figure 5. Requesting input(Touch Trigger)

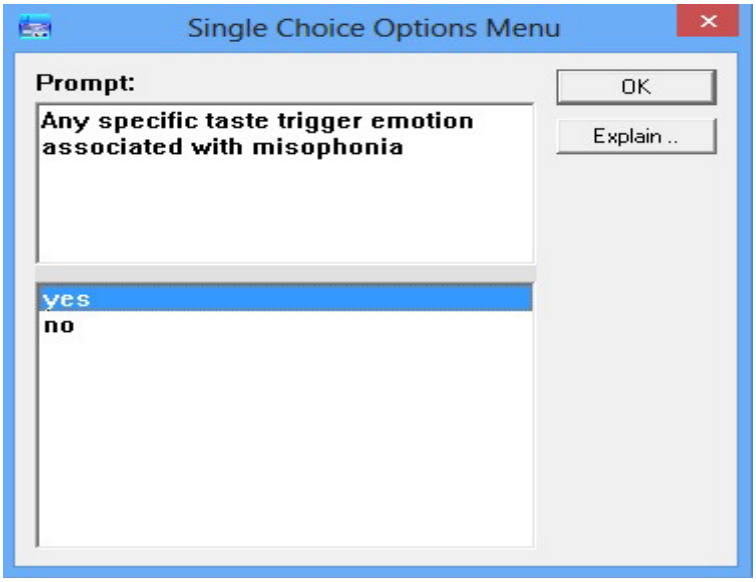


Figure 6.Requestinginput (TasteTrigger)

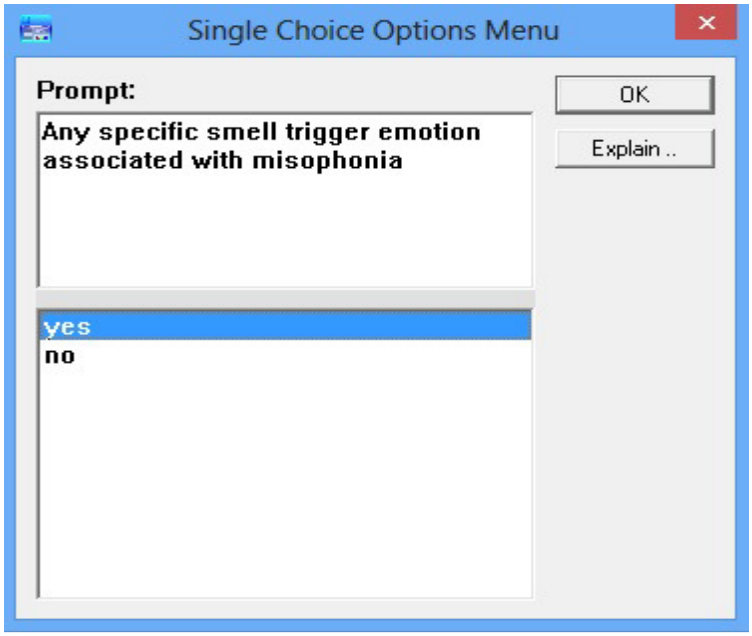


Figure 7. Requesting input (Smell Trigger)

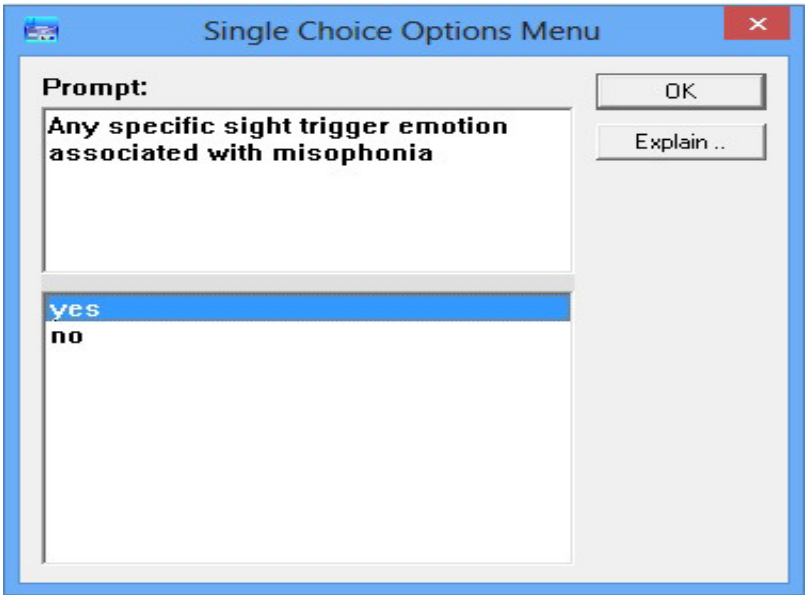


Figure 8. Requesting input (Sight Trigger)

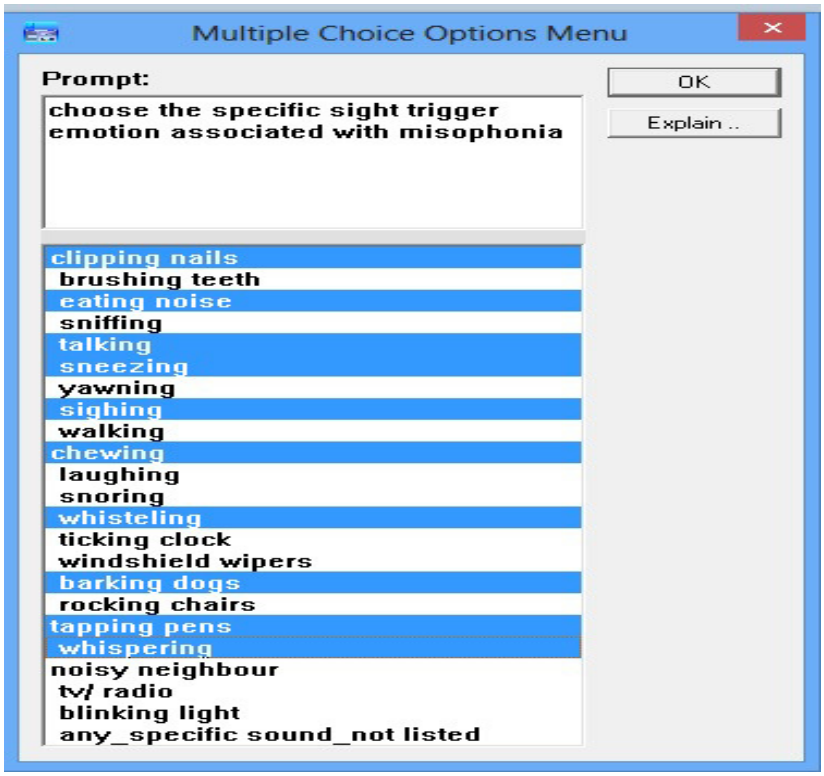


Figure 9. Requesting to choose the specific Cause for Sight Triggering

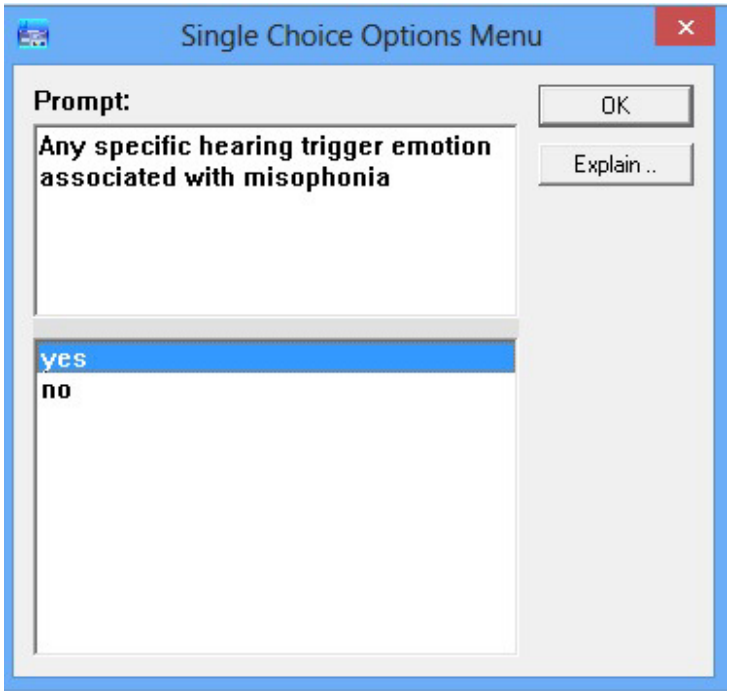


Figure 10. Requesting input (Hearing Trigger)

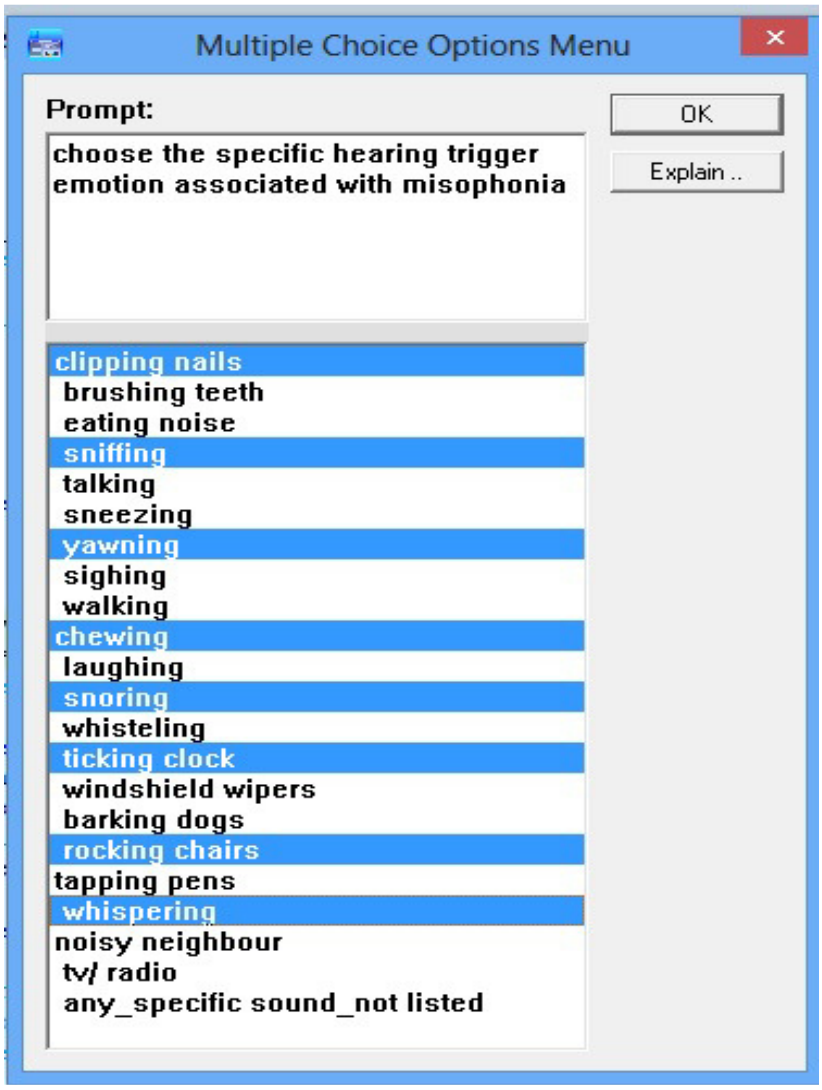


Figure 11. Requesting to choose the specific Cause for Hearing Triggering

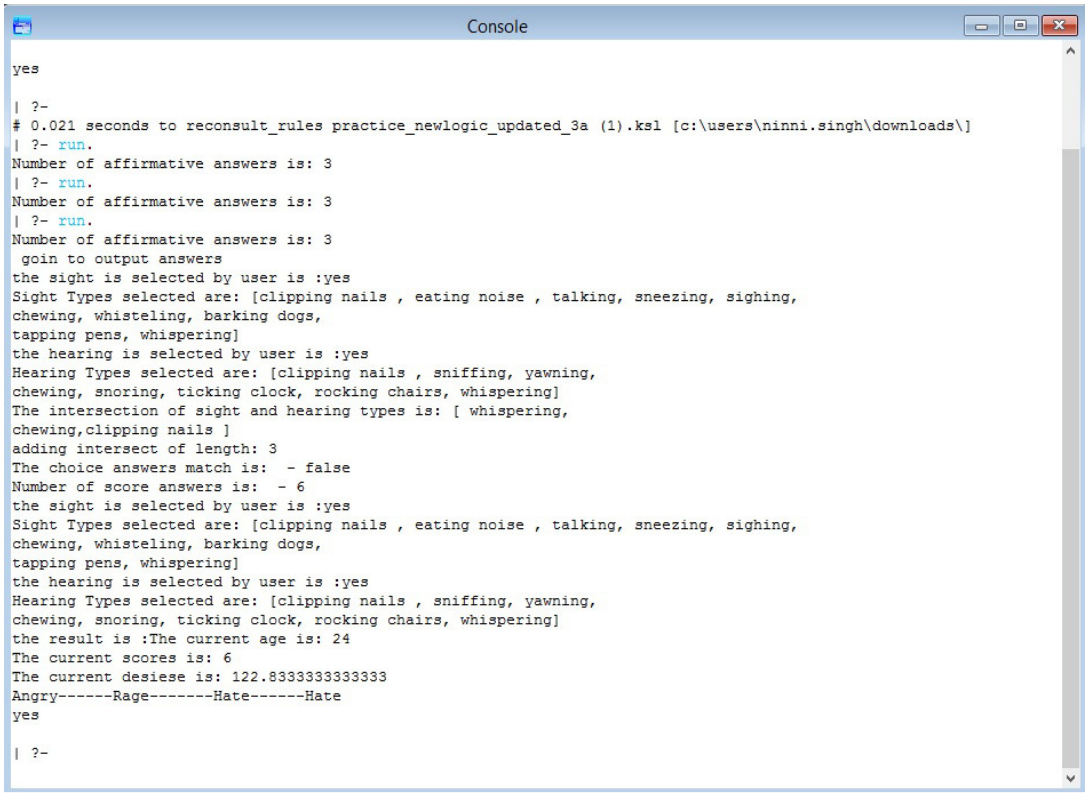


Figure 12. Identification of Disease by the System on the basis of previously asked questions

CONCLUSION

We have drawn an inference from an online survey and proposed fuzzy logic based methodology for early identification of symptoms associated with misophonia.

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ANNEXURE I

```
action run
   do restart
  and rerun .

action rerun
   do global_yesno_score := 0
  and ask firstname
%  and ask age
  and set_misophoniaf_age(age)

  and ask touch
  and ask taste
  and ask smell
  and count_yesnos
  and write( 'Number of affirmative answers is: ' )   and write( global_yesno_score )
  and nl
  and ask sight
  and test
%  and if sight = yes then ask sight_yes else ask hearing end if
%  and if hearing = yes then ask hearing_yes else true end if
  and check_sightyes_types_answers
  and intersect
  and check that length( intersect, Z )
  and write( 'adding intersect of length: ' ) and write( Z ) and nl
  and add Z to global_yesno_score
  and set_misophoniaf_scores(global_yesno_score)
  and write( 'The choice answers match is: ' - same_sightyes_types_answers )
  and nl
  and write( 'Number of score answers is: ' - global_yesno_score )
  and nl
  and output_answers
  and display_misophoniaf_values
  and check_remedie
  and nl.

action output_answers
 do write( 'the sight is selected by user is :' )
  and write( sight )
  and nl
  and if   sight = yes then output_sight_types else true end if

  and write( 'the hearing is selected by user is :' )
  and write( hearing )
  and nl
  and if hearing = yes then output_hearing_types else true end if .

action output_sight_types
   do write( 'Sight Types selected are: ' )
  and write( sight_yes )
  and nl .

action output_hearing_types
   do write( 'Hearing Types selected are: ' )
  and write( hearing_yes )
  and nl .
```

```
action intersect
   do intersect := {}
    and for every member( X, sight_yes )
        do check that is_member( X, hearing_yes )
      end for
    and write( 'The intersection of sight and hearing types is: ' ) and write( intersect ) and nl .

action is_member( X, Y )
   do if member( X, Y ) then include X in intersect else true end if .


question firstname
  Please enter your first name ;
  input name .

question age
  'Please enter your age
[This must be entered as an integer]';
  input integer .

question touch
   Any specific touch trigger emotion associated with misophonia ;
   choose one of touch_types  .

group touch_types
   yes, no.

question taste
   Any specific taste trigger emotion associated with misophonia ;
   choose one of taste_types  .

group taste_types
   yes, no.

question smell
   Any specific smell trigger emotion associated with misophonia ;
   choose one of smell_types  .

group smell_types
   yes, no.

action count_yesnos;
  do global_yesno_score := 0
    and if touch = yes then global_yesno_score := global_yesno_score + 1 else true end if
    and if taste = yes then global_yesno_score := global_yesno_score + 1 else true end if
    and if smell = yes then global_yesno_score := global_yesno_score + 1 else true end if .

action test
   do if   sight = yes then ask   sight_yes else true end if
  and ask hearing
  and if hearing = yes then ask hearing_yes else true end if
  and write(' goin to output answers ')   and nl
  and output_answers .

question sight
  Any specific sight trigger emotion associated with misophonia ;
  choose one of sight_types  .
```

```
group sight_types
  yes, no.

question sight_yes
  choose the specific sight trigger emotion associated with misophonia ;
  choose some of sightyes_types  .

group sightyes_types
  'clipping nails ',' brushing teeth ',' eating noise ',' sniffing',' talking',' sneezing',' yawning',' sighing',' walking','
chewing',' laughing',' snoring',' whisteling',' ticking clock',' windshield wipers',' barking dogs',' rocking chairs','
tapping pens',' whispering','noisy neighbour',' tv/ radio',' blinking light',' any_specific sound_not listed' .

question hearing
  Any specific hearing trigger emotion associated with misophonia ;
  choose one of hearing_types  .

group hearing_types
  yes, no.

question hearing_yes
  choose the specific hearing trigger emotion associated with misophonia ;
  choose some of hearingyes_types  .

group hearingyes_types
    'clipping nails ',' brushing teeth ',' eating noise ',' sniffing',' talking',' sneezing',' yawning',' sighing',' walking','
chewing',' laughing',' snoring',' whisteling',' ticking clock',' windshield wipers',' barking dogs',' rocking chairs','
tapping pens',' whispering','noisy neighbour',' tv/ radio ',' any_specific sound_not listed '.


action check_sightyes_types_answers;
  do same_sightyes_types_answers := false
    and if sight = yes   and hearing = yes    and sight_yes = hearing_yes
  then global_yesno_score := global_yesno_score + 1 else true end if
    and if sight_yes = hearing_yes then same_sightyes_types_answers := true else true end if.
%  and if sight_yes = hearing_yes then global_yesno_score := global_yesno_score + 1 else true end if.

fuzzy_variable age;
  ranges from 0 to 50 ;
  fuzzy_set child   is \  shaped   and linear at 12 , 16     ;
  fuzzy_set teen  is /\ shaped   and linear at 15 , 19 , 21 ;
  fuzzy_set adult is /\ shaped   and linear at 20 , 26 ,30 ;
  fuzzy_set average is /\ shaped   and linear at 29 , 36 ,40 ;
  fuzzy_set old is /\ shaped   and linear at 39 , 45 ,50 .

fuzzy_variable scores;
  ranges from 0 to 27 ;
  fuzzy_set marks1  is \  shaped   and linear at 0 ,  10        ;
  fuzzy_set marks2  is /\ shaped   and linear at 9 ,  11 , 13  ;
  fuzzy_set marks3   is \ shaped   and linear at 14  , 27  .

fuzzy_variable desiese;
  ranges from 0 to 192  ;
  fuzzy_set daph  is \  shaped   and linear at 0 , 30     ;
  fuzzy_set aarh is /\ shaped   and linear at 31 , 40 , 50;
  fuzzy_set daah  is /\ shaped   and linear at 51 , 60 , 70 ;
  fuzzy_set aahd is /\ shaped   and linear at 75, 80, 85;
  fuzzy_set arah is /\ shaped   and linear at 86, 90, 95;
  fuzzy_set arhh is /\ shaped   and linear at 96, 100, 105;
  fuzzy_set dahh is /\ shaped   and linear at 106, 110, 115;
```

```
  fuzzy_set arhh1 is /\ shaped   and linear at 116, 120, 125;
  fuzzy_set adhd is /\ shaped   and linear at 126, 130,135;
  fuzzy_set aahr is /\ shaped   and linear at 136, 140,145;
  fuzzy_set rahh is /\ shaped   and linear at 146,150, 155;
  fuzzy_set aadh is /\ shaped   and linear at 156, 160,165;
  fuzzy_set arad is /\ shaped   and linear at 166,170,175;
  fuzzy_set adrh is /\ shaped   and linear at 176,180,185;
  fuzzy_set addh is /\ shaped   and linear at 186,190,192;
  defuzzify using
     all memberships
       and mirror rule
       and shrinking .

fuzzy_matrix recommend_value
   age         *  scores       ->  desiese;

   child       *  marks1       ->  daph   ;
   child       *  marks2       ->  daah   ;
   child       *  marks3       ->  aarh   ;
   teen        *  marks1       ->  aahd   ;
   teen        *  marks2       ->  arah   ;
   teen        *  marks3       ->  arhh   ;
   adult       *  marks1       ->  dahh   ;
   adult       *  marks2       ->  arhh1  ;
   adult       *  marks3       ->  adhd   ;
   average     *  marks1       ->  aahr   ;
   average     *  marks2       ->  rahh   ;
   average     *  marks3       ->  aadh   ;
   old         *  marks1       ->  arad   ;
   old         *  marks2       ->  adrh   ;
   old         *  marks3       ->  addh .

relation get_recommend_value(Age,Scores,D)
  if reset all fuzzy values
    and fuzzify the age from Age
    and fuzzify the scores from Scores
    and propagate recommend_value fuzzy rules
%{daphr,daahr, aarhr, aahdr,arahr,arhhr,dahhr,arhh1r,adhdr,aahrr,rahhr,aradr,adrhr,addhr} fuzzy rules
    and defuzzify the desiese to D.

frame misophoniaf
 default desiese is 0
  and default age is 0
  and default scores is 0.

demon react_to_age_update
when the age of misophoniaf changes to P
then set_misophoniaf_desiese .

demon react_to_scores_update
when the scores of misophoniaf changes to M
then set_misophoniaf_desiese .

demon react_to_desiese_update
  when the scores of misophoniaf changes to M
  then set_misophoniaf_desiese .

action set_misophoniaf_age(P)
 do the age of misophoniaf becomes P .
```

```
action set_misophoniaf_scores(M)
 do the scores of misophoniaf becomes M .

action set_misophoniaf_desiese
 do  check the age of misophoniaf is Age
  and check the scores of misophoniaf is Scores
  and get_recommend_value(Age,Scores,Desiese)
  and the desiese of misophoniaf becomes Desiese .

action display_misophoniaf_values
  do write ('the result is :')
    and write('The current age is: ')
    and write(the age of misophoniaf)
    and nl
    and write('The current scores is: ')
    and write(the scores of misophoniaf)
    and nl
    and write('The current desiese is: ')
    and write(the desiese of misophoniaf)
  and nl
.

action check_remedie;
do
 if the desiese of the misophoniaf is greater than or equal to 0   and the desiese of the misophoniaf is less than or equal
to 30
  and write('Disgust------Angry-------Panic-------Hate') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 31   and the desiese of the misophoniaf is less than or equal
to 50
  and write('Angry------Angry-------Rage-------Hate') then true else true end if
  and
if the desiese of the misophoniaf  is greater than or equal to 51   and the desiese of the misophoniaf is less than or equal
to 70
  and write('Disgust----Angry------Angry-------Hate') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 71   and the desiese of the misophoniaf is less than or equal
to 85
  and write('Angry---------Angry------Hate-------Disgust') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 86   and the desiese of the misophoniaf is less than or equal
to 95
  and write('Angry-------Rage-------Angry-------Hate') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 96   and the desiese of the misophoniaf is less than or equal
to 105
  and write('Angry-------Rage------Hate-----Hate') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 106   and the desiese of the misophoniaf is less than or equal
to 115
  and write('Disgust--------Angry--------Hate-------Hate') then true else true end if
  and
if the desiese of the misophoniaf is greater than or equal to 116   and the desiese of the misophoniaf is less than or equal
to 125
  and write('Angry------Rage-------Hate------Hate') then true else true end if
  and
```

if the desiese of the misophoniaf is greater than or equal to 126 and the desiese of the misophoniaf is less than or equal to 135
and write('Angry------Disgust-----Hate------Disgust') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 136 and the desiese of the misophoniaf is less than or equal to 145
and write('Angry------Angry------Hate------Rage') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 146 and the desiese of the misophoniaf is less than or equal to 155
and write('Rage------Angry------Hate------Hate') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 156 and the desiese of the misophoniaf is less than or equal to 165
and write('Angry------Angry------Disgust------Hate') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 166 and the desiese of the misophoniaf is less than or equal to 175
and write('Angry------Rage------Anger------Disgust') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 176 and the desiese of the misophoniaf is less than or equal to 185
and write('Angry------Disgust------Rage-----Hate') then true else true end if
and
if the desiese of the misophoniaf is greater than or equal to 186 and the desiese of the misophoniaf is less than or equal to 192
and write('Angry--------Disgust------Disgust------Hate') then true else true end if.