Interaction with sound for participatory systems and data sonification

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APPENDIX A

Supplementary materials for Chapter 4

Expert Review Checklist

Checklist

	Poor	Fair	Average	Good	Excellent
Learnablity					
I can recognize the similarities and dissimilarities among the sounds without introduction.					
After a brief introduction I can understand it and repeat it.					
Immediacy					
I am able to recognize one sound fast. (within 2 seconds)					
I do not have to remember each sound intentionally.					
Segregation					
I can easily separate one sound from other sounds when played in parallel.					
The sound is clearly heard when there are four same sounds from four directions.					
Localization					
The sound is easy to be localized from all directions.					
The sound is easy to be localized on all layers.					

APPENDIX B

Supplementary materials for Chapter 5

Instructions for Experiment I

Experiment Instructions

Thank you for agreeing to participate in our sonification study. The experiment will take you approximately 25-30 minutes. There are four speakers around you, which will play sounds during the experiment. You are free to change your head orientation, but please do not move the chair. The experiment consists of four phases:

Phase 1 Introduction (~ 2 minutes)

We designed four different sounds representing four chemical elements H, C, N, O. You can press the keys of h, c, n, o on the keyboard to playback the corresponding sounds, and press ESC to stop playing.

Phase 2 Pre-test (~ 7 minutes)

You will hear 28 sound samples, the duration of each sample will be 4 or 8 seconds. The sounds may come from four different directions (speakers) around you. Each direction will contain up to one sound source. You can use mouse (left click) to choose corresponding elements from each direction as you hear. You can change your head orientation during the test. You are allowed to leave uncertain part blank. You can press ENTER to start, each time when you finish answering please press ENTER again to go to the next question.

Phase3 Practice with feedback (~ 5 minutes)

You may have already found the differences among sounds. In this phase, you will hear several sound samples and be asked several questions as practice to get familiar with the sound design. Feedback will be provided on your answers.

Phase 4 Post-test (~ 7 minutes)

You will hear 28 sound samples, the duration of each sample will be 4 or 8 seconds. The sounds may come from four different directions (speakers) around you. Each direction will contain up to one sound source. You can use mouse (left click) to choose corresponding elements from each direction as you hear. You can change your head orientation during the test. You are allowed to leave uncertain part blank. You can press ENTER to start, each time when you finish answering please press ENTER again to go to the next question.

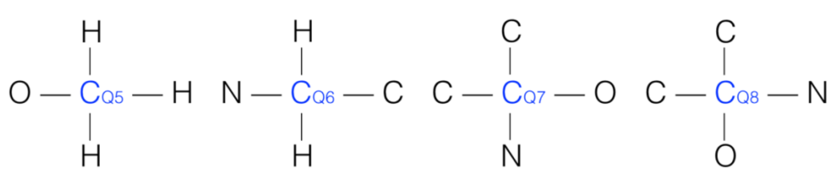
Training Session in Experiment I

No.____ Date__________

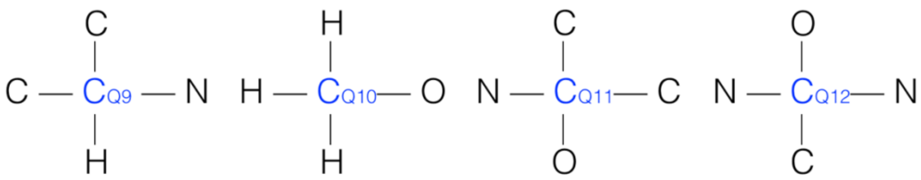
Practice with feedback

1) There are two sound sources around you. It is C from left, and what do you hear from right?
2) There are two sound sources around you. It is O from left, and what do you hear from right?
3) There are two sound sources around you. It is H from left, and what do you hear from right?
4) There are two sound sources around you. It is N from left, and what do you hear from right?

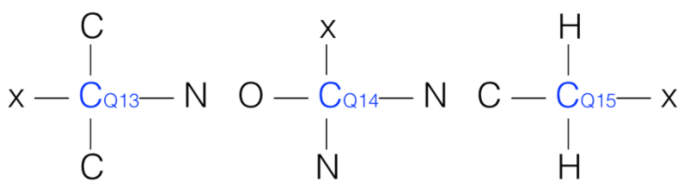
5) There are four sound sources around you. How many nitrogen atoms can you hear? Please point them out (direction).
6) There are three sound sources around you. How many hydrogen atoms can you hear? Please point them out (direction).
7) There are four sound sources around you. How many carbon atoms can you hear? Please point them out (direction).
8) There are four sound sources around you. How many oxygen atoms can you hear? Please point them out (direction).



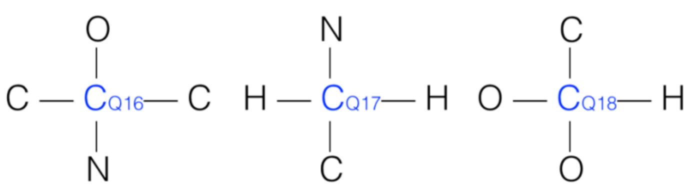
9) There is a carbon atom in front of you, what are the other three atoms around you? Please point out their directions and name them.
10) There is a hydrogen atom from your left, what are the other three atoms around you? Please point out their directions and name them.
11) There is an oxygen atom from your back, what are the other three atoms around you? Please point out their directions and name them.
12) There is a nitrogen atom from your right, what are the other three atoms around you? Please point out their directions and name them.



13) You will hear three sound sources, please point their directions and name each atom.
14) You will hear three sound sources, please point their directions and name each atom.
15) You will hear three sound sources, please point their directions and name each atom.



16) You will hear four sound sources, please point their directions and name each atom.
17) You will hear four sound sources, please point their directions and name each atom.
18) You will hear four sound sources, please point their directions and name each atom.



APPENDIX C

Supplementary materials for Chapter 6

Instructions for Experiment II

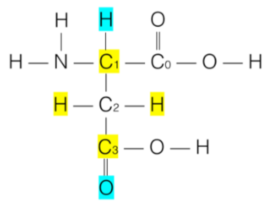
Experiment Instructions

Thank you for agreeing to participate in our sonification study. There are four speakers around you, which will play sounds during the experiment. You are free to change your head orientation, but please do not move the chair.

Phase 1 Introduction (~ 3 minutes)

Element: We designed four different sounds representing four chemical elements H, C, N, O. *We used pitch and density as two main features for the sound design in accordance with the weight differences of the four elements.*

Layer: If you are standing on C_2 (please see the figure right beside):
a) First layer: only sonifying the atoms directly connected to the current carbon position (marked as yellow ones).
b) Second layer: also sonifying atoms behind the directly connected atoms (marked as light blue ones).



Example: Now you are standing on C_0 (see the figure below), you will hear three sounds adding one by one from your right. C_1 is on the first layer, C_2 is on the second layer and H is on the third layer. *On one hand, the distance determines the loudness and the sound of C_1 is the loudest. On the other hand, C_2 has slightly higher pitch and more resonance, which becomes less sharp and intensive. Reverb is employed to enhance the sensation of distance of atoms in the second layer.*

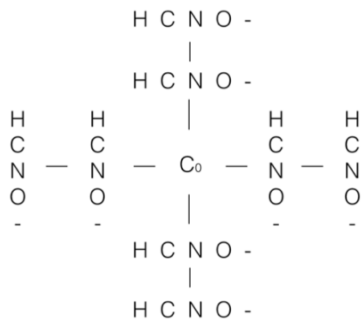
C_0 — C_1 — C_2

Phase 2 Training (~10 minutes)

You may have already found the differences among sounds. In this phase, you will hear several sound samples and be asked several questions as practice to get familiar with the sound design. Feedback will be provided on your answers.

Phase 3 Test - Condition 1 (~ 5 minutes)

You will hear 8 set of sounds. In each set there will be maximally 8 sound positioned around you. The first layer of sounds will be played first. After 10 seconds, the second layer of sounds will be played. Each layer will contain up to 4 sounds from four directions. Please use mouse (left click) to choose corresponding elements from each direction and layer as you hear. You can change your head orientation during the test. Please choose “-” if there is no sound heard.



Interface: You will hear three examples before the test, to get familiar with the interface.

Phase 4 Test - Condition 2 (~ 5 minutes)

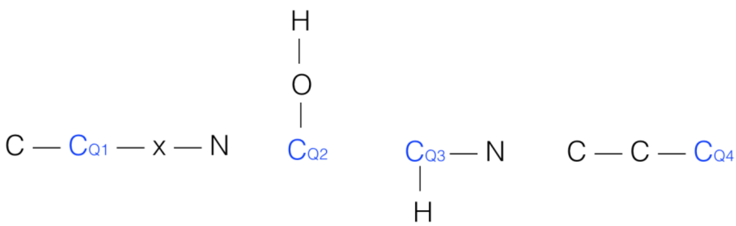
You will hear 8 sound samples, the duration of each sample will be 20 seconds. The sounds may come from four different directions (speakers) around you. Each direction will contain up to two layers of sound sources. You can use mouse (left click) to choose corresponding elements from each direction as you hear. You can change your head orientation during the test. Please choose “-” if there is no sound heard.

Training Session in Experiment II

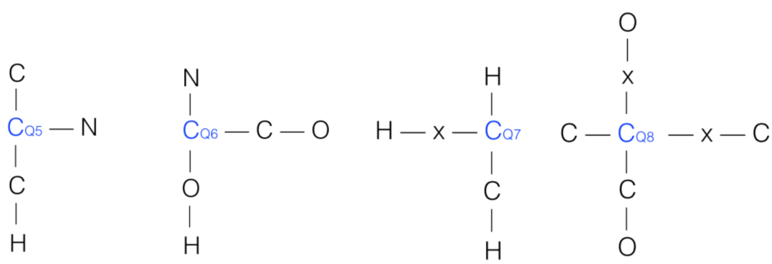
No.____ Date__________

Training

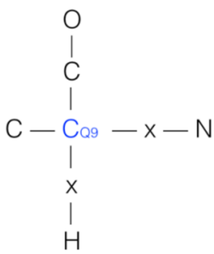
1) There is a nitrogen atom on the second layer. Now a new sound is added, which layer is this sound object on?
2) There is an oxygen atom on the first layer. Now a new sound is added, which layer is this sound object on?
3) There is a hydrogen atom on the second layer. Now a new sound is added, which layer is this sound object on?
4) There is a carbon atom on the first layer. Now a new sound is added, which layer is this sound object on?

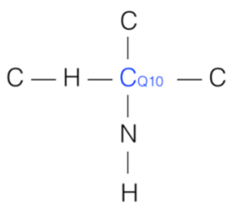


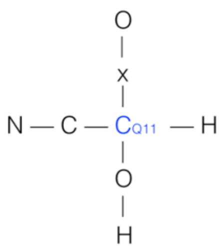
5) There are several sounds around you. How many nitrogen atoms are positioned on the first layer? Please point them out (direction).
6) There are several sounds around you. How many oxygen atoms are positioned on the first layer? Please point them out (direction).
7) There are several sounds around you. How many hydrogen atoms are positioned on the second layer? Please point them out (direction).
8) There are several sounds around you. How many carbon atoms are positioned on the second layer? Please point them out (direction).

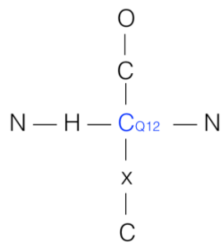


9) There is a carbon atom in front of you, four atoms will be added around you one by one? Please point out their directions, layers and element name.
10) There is a hydrogen atom from your left, four atoms will be added around you one by one? Please point out their directions, layers and element name.
11) There is an oxygen atom from your back, five atoms will be added around you one by one Please point out their directions, layers and element name.
12) There is a nitrogen atom from your right, six atoms will be added around you one by one? Please point out their directions, layers and element name.

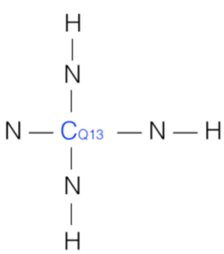


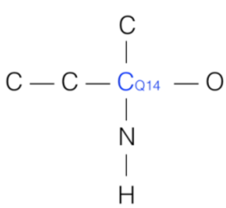


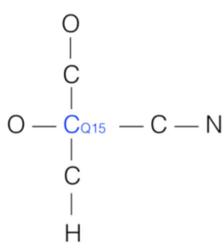


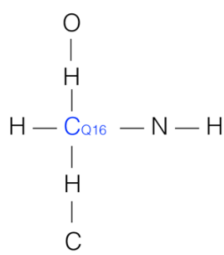


13) You will hear seven sound sources, please point out their directions, layers and name each atom.
14) You will hear six sound sources, please point out their directions, layers and name each atom.
15) You will hear seven sound sources, please point out their directions, layers and name each atom.
16) You will hear seven sound sources, please point out their directions, layers and name each atom.









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