

Supplementary Material for Continuous Sonification Enhances Adequacy of Interactions in Peripheral Process Monitoring.

VP-ID: \_\_\_\_\_

Condition sequence: \_\_\_\_\_

Personal data

Study course, respectively occupation \_\_\_\_\_

Age: \_\_\_\_\_ Years

Gender:  male  female  do not want to specify

First language  German  other \_\_\_\_\_

		Does not apply	Rather not applies	Rather applies	Fully applies	No comment
Id	Question	1	2	3	4	
A1	Do you have hearing impairments?					
A2	Do you have visual impairments?					
A3	Are you experienced with the development or application of process simulation?					
A4	Are you able to play an instrument?					
A5	Are you experienced with sound production, audio editing or – programming?					
A6	Are you experienced with the application or development of sonifications?					

Visualization condition

VP-ID: \_\_\_\_\_

Please indicate on a scale of 0 (does not apply at all) to 10 (does fully apply) to what extent you agree to the following statements.

7. I have understood the principles of the process simulation.

[0

8. I have understood the interaction possibilities (supply, empty, maintain).

[0

9. I have felt overwhelmed by the process simulation.

[0

10. I have felt overwhelmed by the arithmetic problems.

[0

11. It was difficult to switch my attention between the arithmetic problems and the process simulation.

[0

12. I was in control of the process simulation at all times.

[0

13. I have reacted in time when complications during simulation (e.g. an input buffer running empty) occurred.

[0

14. I have intervened in the process simulation more often than necessary.

[0

15. I have produced a large quantity of units.

[0

16. I have solved a large amount of arithmetic problems.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

17. I have improved my performance at process simulation over time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

18. I have improved my performance at arithmetic problems over time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

19. I have been informed about potential problems during process simulation in time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

20. The elements of the process simulation were arranged clearly and understandable.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

21. I have understood the foundations of the process visualization (e.g. the coloring of the filling levels).

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

22. The previous experiment condition was exhausting.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

23. Over time, my performance at the process simulation has decreased (e.g. due to difficulties in concentrating).

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

24. Over time, my performance at the arithmetic problems has decreased (e.g. due to difficulties in concentrating).

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

Do you have comments, notes and suggestions concerning the previous experiment condition, and the presented mode of process monitoring?

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SOTA condition

VP-ID: \_\_\_\_\_

Please indicate on a scale of 0 (does not apply at all) to 10 (does fully apply) to what extent you agree to the following statements.

25. I have felt overwhelmed by the process simulation.

[0

26. I have felt overwhelmed by the arithmetic problems.

[0

27. It was difficult to switch my attention between the arithmetic problems and the process simulation.

[0

28. I was in control of the process simulation at all times.

[0

29. I have reacted in time when complications during simulation (e.g. an input buffer running empty) occurred.

[0

30. I have intervened in the process simulation more often than necessary.

[0

31. I have produced a large quantity of units.

[0

32. I have solved a large amount of arithmetic problems.

[0

33. I have improved my performance at process simulation over time.

[0

34. I have improved my performance at arithmetic problems over time.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
35. I have been informed about potential problems during process simulation in time.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
36. The previous experiment condition was exhausting.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
37. Over time, my performance at the process simulation has decreased (e.g. due to difficulties in concentrating).  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
38. Over time, my performance at the arithmetic problems has decreased (e.g. due to difficulties in concentrating).  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
39. A longer familiarization period with the sounds would have been necessary.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
40. The sounds have helped me to perceive already occurred problems.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
41. The sounds were intrusive.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
42. My reaction times have been improved by the sounds.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
43. I have based my decisions during process simulation mainly on the sounds.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
44. I would be able to perform the mode of process monitoring presented in the previous part of the experiment for a longer period of time (without parallel arithmetic problems),  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]
45. The volume of the sounds has been too low.  
[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

46. I have based my decisions during process simulation mainly on the graphical representation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

Do you have comments, notes and suggestions concerning the previous experiment condition, and the presented mode of process monitoring?

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Soundscape condition

VP-ID: \_\_\_\_\_

Please indicate on a scale of 0 (does not apply at all) to 10 (does fully apply) to what extent you agree to the following statements.

47. I have felt overwhelmed by the process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

48. I have felt overwhelmed by the arithmetic problems.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

49. It was difficult to switch my attention between the arithmetic problems and the process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

50. I was in control of the process simulation at all times.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

51. I have reacted in time when complications during simulation (e.g. an input buffer running empty) occurred.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

52. I have intervened in the process simulation more often than necessary.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

53. I have produced a large quantity of units.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

54. I have solved a large amount of arithmetic problems.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

55. I have improved my performance at process simulation over time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

56. I have improved my performance at arithmetic problems over time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

57. I have been informed about potential problems during process simulation in time.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

58. The previous experiment condition was exhausting.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

59. Over time, my performance at the process simulation has decreased (e.g. due to difficulties in concentrating).

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

60. Over time, my performance at the arithmetic problems has decreased (e.g. due to difficulties in concentrating).

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

61. A longer familiarization period with the sounds would have been necessary.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

62. The sounds have helped me to perceive already occurred problems.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

63. The sounds have helped me to perceive potential disruptions before they have occurred.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

64. The sounds were intrusive.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

65. My reaction times have been improved by the sounds.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

66. I have based my decisions during process simulation mainly on the sounds.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

67. I would be able to perform the mode of process monitoring presented in the previous part of the experiment for a longer period of time (without parallel arithmetic problems),

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]



68. The volume of the sounds has been too low.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

69. I have based my decisions during process simulation mainly on the graphical representation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

70. The previously presented sounds are informative.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

71. ...helpful for incidental process monitoring.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

72. ...intrusive.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

73. ...pleasing.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

74. ...understandable.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

75. ...euphonious.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

76. ... irritating.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

77. I find the interplay of the individual sounds coherent.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

78. ... logical and intuitive.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

79. I had to concentrate very hard to perceive and understand the sounds and their meaning.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

80. Over time, I had to concentrate less hard to perceive and understand the sounds and their meaning.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

81. I was able to distinguish the individual sounds.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

82. I was able to assign the sounds to the respective machines.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

83. The acoustic alerts of machines that have broken down were easy to understand.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

84. ... helpful.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

85. The mapping of potential standstills onto volume was easy to understand.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

86. ... helpful.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

87. The mapping of emptying input buffers onto the distortion of the sound was easy to understand.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

88. ... helpful.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

89. The acoustic representation of filling output buffers through an increase in pitch was easy to understand.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

90. ... helpful.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

Do you have comments, notes and suggestions concerning the previous experiment condition, and the presented mode of process monitoring?

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Concluding questions

VP-ID: \_\_\_\_\_

Please indicate on a scale of 0 (does not apply at all) and 10 (does fully apply) to what extent you agree to the following statements.

**91. How helpful have the different presented modes of process monitoring been?**

91a. Purely visual monitoring.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

91b. Additional auditory display of alerts.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

91c. Extended, continuous auditory representation during process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

**92. How exhausting have the different presented modes of process monitoring been?**

92a. Purely visual monitoring.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

92b. Additional auditory display of alerts.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

92c. Extended, continuous auditory representation during process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

**93. How pleasing have the different presented modes of process monitoring been?**

93a. Purely visual monitoring.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

93b. Additional auditory display of alerts.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

93c. Extended, continuous auditory representation during process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

**94. How distracting have the different presented modes of process monitoring been?**

94a. Purely visual monitoring.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

94b. Additional auditory display of alerts.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

94c. Extended, continuous auditory representation during process simulation.

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

**> If the first condition included sound:**

95. Did you miss the sounds later during the purely visual part of the experiment?

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

96. Did you enjoy the silence later during the purely visual part of the experiment?

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

**> If the first condition did not include sound:**

97. Did the sound during later parts of the experiment help you to get a better “feeling” of the occurrences during process simulation?

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

98. Do you in general agree, that sound can be helpful for process monitoring (independent of the application areas presented in this experiment)?

[0 ] [1 ] [2 ] [3 ] [4 ] [5 ] [6 ] [7 ] [8 ] [9 ] [10 ]

Do you have comments, notes and suggestions concerning the previous experiment condition, and the presented mode of process monitoring?

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