Providing Timbre Maps for Musicians Based on Similarity Judgements of an Instrumental Duo's Extended Techniques

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D1

The underlying project - *Timbrenauts : explorations in timbre space*

- The team a collaboration with trombonist and co-researcher Berk Schneider (UC San Diego), cellist Peter Ko (UCSD) and composers Janet Sit (UCSD) and Louis Goldford (Columbia University), awarded funding as an ACTOR student collaboration project; the perceptual experiment portion was run at the Music Perception and Cognition Laboratory with prof. Stephen McAdams and Bennett Smith

A_{yz} MSS 0.6 - dimensions 2 and 3 of the MSS 0.2 0 CloPitchSus D3 0-**TbnPitchSus** . CloPitchPunct TbnPitchPunct CloPitSusMute **TbnPitSusMute** -0.2 CloPitchGran TbnPitchGran CloPitSusDist TbnPitSusDist CloMultiSus **TbnMultiSus** -0.4CloOvertoVar

- The goal to bring methods from timbre and orchestration research into a research-creation project focused on contemporary practice and new music which utilizes extended instrumental techniques not typically investigated in empirical studies, after which the musicians in the project will use the data to create new compositions and improvisations
- Methods we recorded a dataset of extended techniques on trombone and cello, then ran a similarity judgement experiment (n=29) on 10 sounds from each instrument based on a diverse set of phenomenological sound categories

How to present the data and models

- Feedback wanted which of these plots are most evocative, and what other data would you find helpful and/or interesting
 - [Axyz] Multidimensional Similarity Space (MSS) made using SMACOF algorithm based on the experimental similarity ratings
 - [A_{xy}], [A_{xz}], [A_{yz}] two-dimensional views of the MSS, showing dimensions 1 & 2, 1 & 3, and 2 & 3, respectively
 - [B_o] Closest Timbral Neighbours (CTN) network graph connecting stimuli pairs with mean similarity ratings above cutoff, on a circle Ο
 - [B_{xy}] the CTN network graph with the stimuli arranged along dimensions 1 & 2 of the MSS
 - [C₀] Greatest Timbral Diversity (GTD) network graph connecting stimuli pairs with mean similarity ratings below cutoff, on a circle Ο ■ [C_{xy}] - the GTD network graph with the stimuli arranged along dimensions 1 & 2 of the MSS
 - [D] the Mean Similarity Ratings table provides the data collected in the experiment for reference, including standard deviations Ο

Next steps

- Iterate on data presentation use feedback gathered to refine the data models and repository to increase usability
 - Other models proposed: Ο
 - Performance Technique Flow (PTF) a table and/or network graph showing how the physical sound production involved in the above sounds can flow from one to the other (can you play them in quick succession, is continuous interpolation possible between them, or does going from one to the other require a complete pause in sound production)
 - An MDS similar to the MSS here, but with a slightly different algorithm (INDISCAL as opposed to IDIOSCAL) that would allow to find audio descriptor correlations with the dimensions of the space, helping to apply the model to other sounds



- Open access repository share the entire dataset with the public for use by others interested in building on the sounds and data collected
 - If you are interested please get in touch, or stay tuned for updates on our module on the Timbre and Orchestration Resource website



	Mean Similarity Ratings																D			
Similarity	CloPitchSus	TbnPitchSus	CloPitchPunct	TbnPitchPunct	CloPitSusMute	TbnPitSusMute	CloPitchGran	TbnPitchGran	CloPitSusDist	TbnPitSusDist	CloMultiSus	TbnMultiSus	CloOvertoVar	TbnOvertoVar	CloUnpitSus	TbnUnpitSus	CloUnpitPunct	TbnUnpitPunct	CloUnpitGran	TbnUnpitGran
CloPitchSus	-	0.655 (±0.196)	0.591 (±0.265)	0.170 (±0.164)	0.683 (±0.265)	0.683 (±0.179)	0.657 (±0.212)	0.420 (±0.245)	0.338 (±0.255)	0.262 (±0.228)	0.872 (±0.093)	0.566 (±0.188)	0.315 (±0.234)	0.264 (±0.200)	0.314 (±0.228)	0.311 (±0.237)	0.142 (±0.163)	0.120 (±0.145)	0.165 (±0.203)	0.112 (±0.167)
TbnPitchSus	0.655 (±0.196)	-	0.538 (±0.231)	0.244 (±0.180)	0.683 (±0.194)	0.668 (±0.167)	0.369 (±0.228)	0.432 (±0.256)	0.157 (±0.184)	0.423 (±0.242)	0.566 (±0.208)	0.709 (±0.208)	0.182 (±0.190)	0.256 (±0.222)	0.279 (±0.234)	0.336 (±0.231)	0.218 (±0.229)	0.165 (±0.166)	0.092 (±0.139)	0.182 (±0.194)
CloPitchPunct	0.591 (±0.265)	0.538 (±0.231)	2	0.430 (±0.250)	0.677 (±0.235)	0.415 (±0.229)	0.343 (±0.248)	0.214 (±0.214)	0.125 (±0.141)	0.125 (±0.141)	0.494 (±0.286)	0.299 (±0.239)	0.170 (±0.185)	0.193 (±0.165)	0.274 (±0.258)	0.206 (±0.183)	0.411 (±0.275)	0.388 (±0.295)	0.110 (±0.150)	0.349 (±0.263)
TbnPitchPunct	0.170 (±0.164)	0.244 (±0.180)	0.430 (±0.250)	-	0.101 (±0.161)	0.232 (±0.222)	0.252 (±0.225)	0.355 (±0.256)	0.165 (±0.185)	0.287 (±0.266)	0.138 (±0.166)	0.306 (±0.294)	0.058 (±0.087)	0.085 (±0.145)	0.110 (±0.167)	0.167 (±0.210)	0.484 (±0.272)	0.648 (±0.236)	0.344 (±0.276)	0.775 (±0.235)
CloPitSusMute	0.683 (±0.265)	0.683 (±0.194)	0.677 (±0.235)	0.101 (±0.161)		0.630 (±0.218)	0.388 (±0.221)	0.360 (±0.256)	0.155 (±0.173)	0.190 (±0.167)	0.647 (±0.198)	0.447 (±0.242)	0.345 (±0.238)	0.491 (±0.235)	0.613 (±0.281)	0.512 (±0.286)	0.312 (±0.226)	0.249 (±0.231)	0.144 (±0.187)	0.213 (±0.234)
bnPitSusMute	0.683 (±0.179)	0.668 (±0.167)	0.415 (±0.229)	0.232 (±0.222)	0.630 (±0.218)		0.406 (±0.194)	0.397 (±0.206)	0.271 (±0.235)	0.300 (±0.197)	0.594 (±0.187)	0.595 (±0.232)	0.252 (±0.212)	0.250 (±0.207)	0.233 (±0.212)	0.302 (±0.245)	0.137 (±0.182)	0.148 (±0.148)	0.158 (±0.196)	0.162 (±0.163)
CloPitchGran	0.657 (±0.212)	0.369 (±0.228)	0.343 (±0.248)	0.252 (±0.225)	0.388 (±0.221)	0.406 (±0.194)	-	0.497 (±0.244)	0.519 (±0.257)	0.314 (±0.225)	0.625 (±0.265)	0.470 (±0.250)	0.283 (±0.201)	0.194 (±0.195)	0.178 (±0.145)	0.182 (±0.190)	0.343 (±0.247)	0.268 (±0.250)	0.377 (±0.221)	0.086 (±0.127)
TbnPitchGran	0.420 (±0.245)	0.432 (±0.256)	0.214 (±0.214)	0.355 (±0.256)	0.360 (±0.256)	0.397 (±0.206)	0.497 (±0.244)		0.454 (±0.250)	0.654 (±0.265)	0.359 (±0.220)	0.700 (±0.170)	0.203 (±0.216)	0.202 (±0.198)	0.238 (±0.265)	0.253 (±0.266)	0.261 (±0.251)	0.209 (±0.223)	0.295 (±0.233)	0.144 (±0.180)
CloPitSusDist	0.338 (±0.255)	0.157 (±0.184)	0.125 (±0.141)	0.165 (±0.185)	0.155 (±0.173)	0.271 (±0.235)	0.519 (±0.257)	0.454 (±0.250)	2	0.406 (±0.289)	0.396 (±0.273)	0.309 (±0.241)	0.280 (±0.223)	0.224 (±0.240)	0.390 (±0.288)	0.195 (±0.228)	0.252 (±0.219)	0.204 (±0.215)	0.788 (±0.231)	0.152 (±0.208)
TbnPitSusDist	0.262 (±0.228)	0.423 (±0.242)	0.125 (±0.141)	0.287 (±0.266)	0.190 (±0.167)	0.300 (±0.197)	0.314 (±0.225)	0.654 (±0.265)	0.406 (±0.289)	-	0.349 (±0.256)	0.714 (±0.212)	0.197 (±0.197)	0.207 (±0.227)	0.245 (±0.215)	0.252 (±0.245)	0.190 (±0.181)	0.194 (±0.171)	0.268 (±0.245)	0.104 (±0.155)
CloMultiSus	0.872 (±0.093)	0.566 (±0.208)	0.494 (±0.286)	0.138 (±0.166)	0.647 (±0.198)	0.594 (±0.187)	0.625 (±0.265)	0.359 (±0.220)	0.396 (±0.273)	0.349 (±0.256)	221	0.667 (±0.145)	0.279 (±0.205)	0.249 (±0.211)	0.280 (±0.226)	0.252 (±0.223)	0.185 (±0.221)	0.117 (±0.159)	0.195 (±0.216)	0.102 (±0.159)
TbnMultiSus	0.566 (±0.188)	0.709 (±0.208)	0.299 (±0.239)	0.306 (±0.294)	0.447 (±0.242)	0.595 (±0.232)	0.470 (±0.250)	0.700 (±0.170)	0.309 (±0.241)	0.714 (±0.212)	0.667 (±0.145)	5	0.199 (±0.172)	0.179 (±0.181)	0.195 (±0.232)	0.232 (±0.208)	0.132 (±0.152)	0.122 (±0.139)	0.166 (±0.229)	0.114 (±0.156)
CloOvertoVar	0.315 (±0.234)	0.182 (±0.190)	0.170 (±0.185)	0.058 (±0.087)	0.345 (±0.238)	0.252 (±0.212)	0.283 (±0.201)	0.203 (±0.216)	0.280 (±0.223)	0.197 (±0.197)	0.279 (±0.205)	0.199 (±0.172)		0.643 (±0.261)	0.494 (±0.296)	0.424 (±0.310)	0.200 (±0.200)	0.139 (±0.143)	0.165 (±0.175)	0.166 (±0.193)
TbnOvertoVar	0.264 (±0.200)	0.256 (±0.222)	0.193 (±0.165)	0.085 (±0.145)	0.491 (±0.235)	0.250 (±0.207)	0.194 (±0.195)	0.202 (±0.198)	0.224 (±0.240)	0.207 (±0.227)	0.249 (±0.211)	0.179 (±0.181)	0.643 (±0.261)	•	0.743 (±0.211)	0.721 (±0.212)	0.320 (±0.275)	0.244 (±0.252)	0.148 (±0.177)	0.220 (±0.202)
CloUnpitSus	0.314 (±0.228)	0.279 (±0.234)	0.274 (±0.258)	0.110 (±0.167)	0.613 (±0.281)	0.233 (±0.212)	0.178 (±0.145)	0.238 (±0.265)	0.390 (±0.288)	0.245 (±0.215)	0.280 (±0.226)	0.195 (±0.232)	0.494 (±0.296)	0.743 (±0.211)	-	0.855 (±0.145)	0.469 (±0.278)	0.296 (±0.223)	0.149 (±0.144)	0.220 (±0.224)
TbnUnpitSus	0.311 (±0.237)	0.336 (±0.231)	0.206 (±0.183)	0.167 (±0.210)	0.512 (±0.286)	0.302 (±0.245)	0.182 (±0.190)	0.253 (±0.266)	0.195 (±0.228)	0.252 (±0.245)	0.252 (±0.223)	0.232 (±0.208)	0.424 (±0.310)	0.721 (±0.212)	0.855 (±0.145)	-	0.373 (±0.295)	0.306 (±0.273)	0.165 (±0.167)	0.302 (±0.239)
CloUnpitPunct	0.142 (±0.163)	0.218 (±0.229)	0.411 (±0.275)	0.484 (±0.272)	0.312 (±0.226)	0.137 (±0.182)	0.343 (±0.247)	0.261 (±0.251)	0.252 (±0.219)	0.190 (±0.181)	0.185 (±0.221)	0.132 (±0.152)	0.200 (±0.200)	0.320 (±0.275)	0.469 (±0.278)	0.373 (±0.295)	-	0.780 (±0.147)	0.334 (±0.254)	0.451 (±0.287)
TonUnpitPunct	0.120 (±0.145)	0.165 (±0.166)	0.388 (±0.295)	0.648 (±0.236)	0.249 (±0.231)	0.148 (±0.148)	0.268 (±0.250)	0.209 (±0.223)	0.204 (±0.215)	0.194 (±0.171)	0.117 (±0.159)	0.122 (±0.139)	0.139 (±0.143)	0.244 (±0.252)	0.296 (±0.223)	0.306 (±0.273)	0.780 (±0.147)	-	0.229 (±0.200)	0.634 (±0.212)
CloUnpitGran	0.165 (±0.203)	0.092 (±0.139)	0.110 (±0.150)	0.344 (±0.276)	0.144 (±0.187)	0.158 (±0.196)	0.377 (±0.221)	0.295 (±0.233)	0.788 (±0.231)	0.268 (±0.245)	0.195 (±0.216)	0.166 (±0.229)	0.165 (±0.175)	0.148 (±0.177)	0.149 (±0.144)	0.165 (±0.167)	0.334 (±0.254)	0.229 (±0.200)	-	0.214 (±0.230)
TbnUnpitGran	0.112 (±0.167)	0.182 (±0.194)	0.349 (±0.263)	0.775 (±0.235)	0.213 (±0.234)	0.162 (±0.163)	0.086 (±0.127)	0.144 (±0.180)	0.152 (±0.208)	0.104 (±0.155)	0.102 (±0.159)	0.114 (±0.156)	0.166 (±0.193)	0.220 (±0.202)	0.220 (±0.224)	0.302 (±0.239)	0.451 (±0.287)	0.634 (±0.212)	0.214 (±0.230)	023









