

Relatedness and innovation in urban music scenes: The evolution of symbolic knowledge spaces, 1970-2015

Benjamin Klement & Simone Strambach
Philipps-Universität Marburg, Germany

Benjamin.klement@staff.uni-marburg.de
Simone.strambach@staff.uni-marburg.de
twitter.com/innogeo



Introduction

- Composition of knowledge bases: Related variety linked to innovation & economic development (CONTENT & FRENKEN 2016; KOGLER et al. 2013; RIGBY 2015; BOSCHMA et al. 2014)

➔ But not for innovation/knowledge creation in creative industries

By the example of music:

Composition of music scenes

- Specialization
 - Avg. Relatedness
 - Unrelated Variety
 - Related Variety
- of symbolic knowledge base

Quantitative test



Innovativeness of music scene

- Creation
- Combination

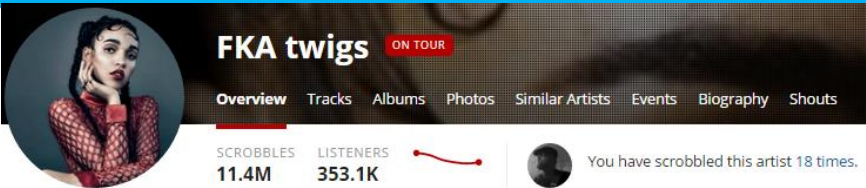
of symbolic knowledge

Symbolic Knowledge

Symbolic knowledge (ASHEIM ET AL. 2011; MARTIN & MOODYSSON 2011; ASHEIM & HANSEN 2009)

- Especially important in creative industries/arts, e.g. music
- Understanding, interpretation and creation of socially constructed symbols
- creation of aesthetic attributes of products, meaning, desire
- “trig reactions in the mind of the consumer” (MARTIN & MOODYSSON 2011)
- Meaning varies across contexts: context-specific, localized interaction

Building Knowledge Spaces from user-generated content



FKA twigs ON TOUR

Overview Tracks Albums Photos Similar Artists Events Biography Shouts

SCROBBLES 11.4M LISTENERS 353.1K

You have scrobbled this artist 18 times.

trip-hop · electronic · lush · experimental · dream pop · alternative rnb Add tags

FKA twigs is a pseudonym of singer, songwriter, producer and dancer **Tahliah Debrett Barnett**. Born January 16, 1988, in Gloucestershire, United Kingdom, she was formerly known as twigs. Named after the way her bones pop and crack; the part-Jamaican, part-Spanish singer now based in London, released a 4 track EP in December 2012.



Grimes ON TOUR

Overview Tracks Albums Photos Similar Artists Events Biography Shouts

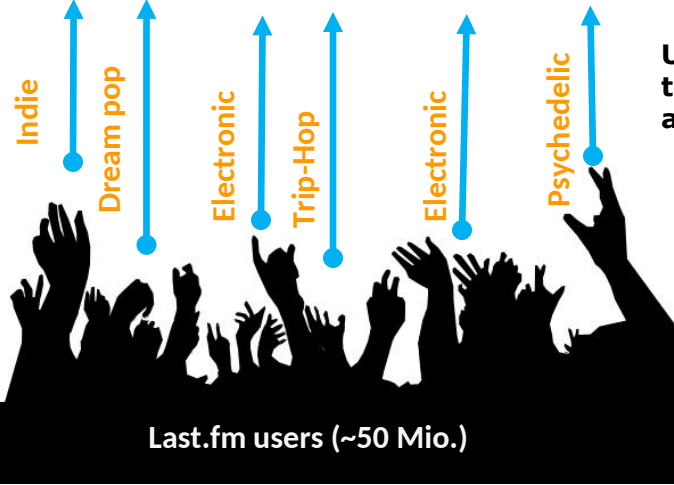
SCROBBLES 41.5M LISTENERS 721.8K

You have scrobbled this artist 580 times.

electronic · dream pop · experimental · psychedelic · poptron · synthpop

Your tags: add music · electronic · indie · ambient · experimental · dream pop · witch house Add tags

The electronic musician Claire Boucher was born in 17 March 1988 in Vancouver, Canada and is based in Montreal. Her music is an eclectic mix of styles which she described herself as "ADD music", because it shifts frequently and



Users tagging artists

Indie, Dream pop, Electronic, Trip-Hop, Electronic, Psychedelic

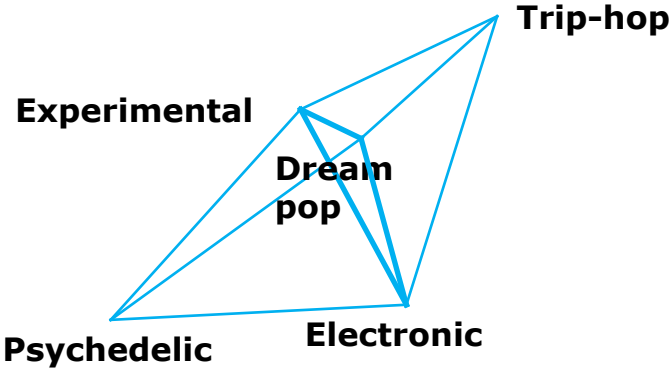
Users listening to artists (=scrobbling) (=artist profiles are created)

Last.fm users (~50 Mio.)



Co-occurrences from 2 artists

lush Alternative-rnb
poptron synthpop



Using tags of all artists from the same city active at certain point in time we construct 33 local music scenes at 9 points in time (1970-2015) as „Symbolic knowledge spaces“ with certain characteristics



Innovativeness of scenes?

Data source: Social music platform www.last.fm

33 cities	8769 artists	919 Genres
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Music Scenes as Knowledge Spaces

Example of the Boston Music Scene 2015

Symbolic knowledge spaces

- Node: Genres
- Node size: $\log(\text{degree})$
- Ties: Co-occurrences
- Colours: „Streams“
- Coordinates: Given by relatedness

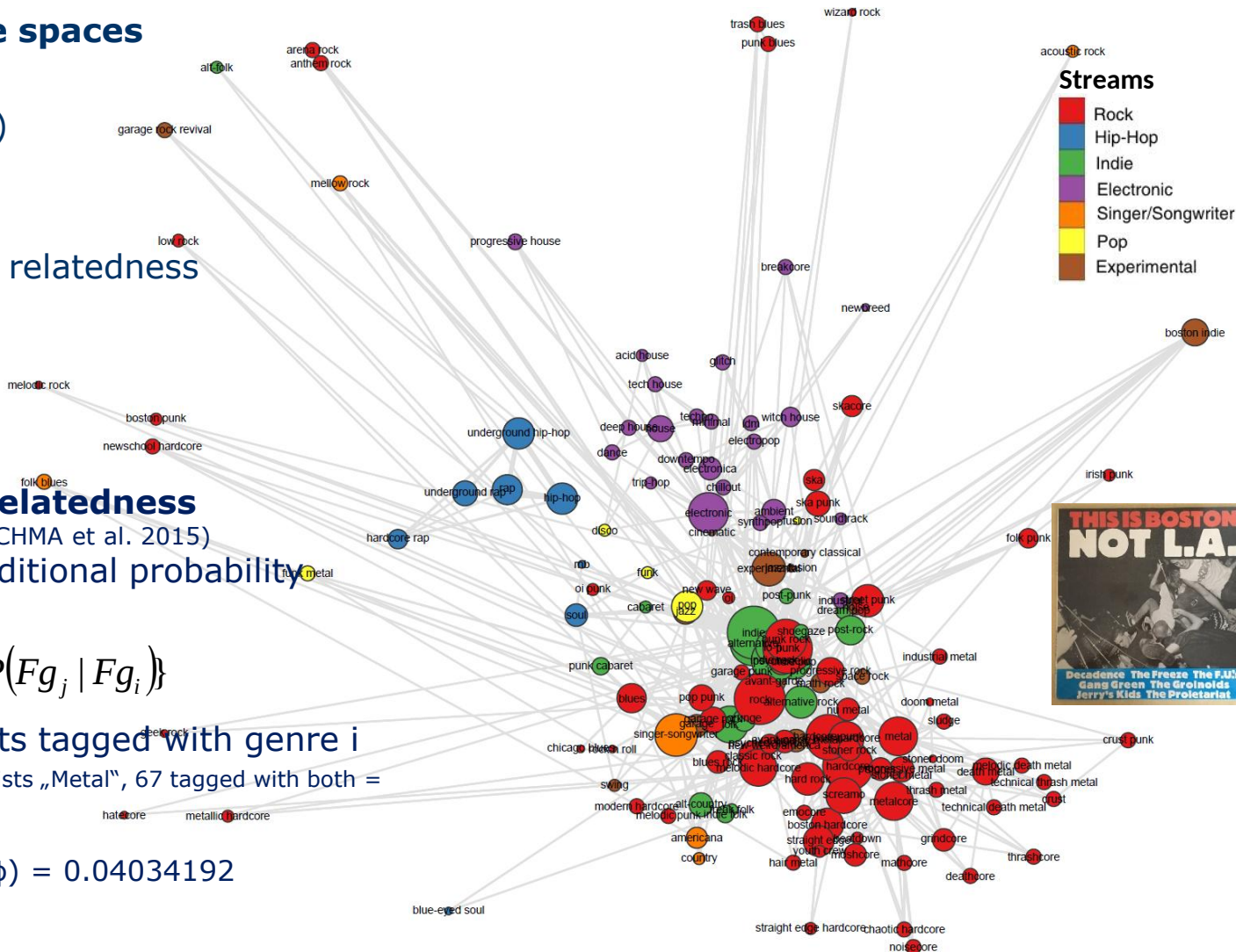
Co-occurrences → Relatedness

(cf. HIDALGO et al. 2007; BOSCHMA et al. 2015)
Minimum pairwise conditional probability

$$\phi_{i,j} = \min\{ P(Fg_i | Fg_j), P(Fg_j | Fg_i) \}$$

F_i = Frequency of artists tagged with genre i
(e.g. 1527 artists „Rock“, 341 artists „Metal“, 67 tagged with both = $67/1527 = 0.0438$)

Related, when $\phi > \text{mean}(\phi) = 0.04034192$



Classification of music genres

2 and 4-digit levels of music classification system

2 requirements

- Hierarchy
- Relatedness within groups

Potential Superordinate genres

- (1) $F_j - F_i > 0$
(Higher frequency of bands)
- (2) $\phi_{ij} > 0.04034192$
(related genre)

- ➔ Amongst related, most popular
- ➔ If no related, maximum (ϕ_{ij})

Aggregate genres with same superordinate

- ➔ Within group:
related to same genre

01 Electronic Music

- 01.00 electronic
- 01.01 ambient
- 01.02 chillout
- 01.03 dance
- 01.04 deep house
- 01.05 downtempo
- 01.06 dubstep
- 01.07 electro
- 01.08 electronica
- 01.09 house
- 01.10 idm
- 01.11 industrial
- 01.12 minimal
- 01.13 rocktronica
- 01.14 synthpop
- 01.15 techno
- 01.16 trip-hop

02 Experimental

- 02.00 experimental
- 02.01 avant-garde
- 02.02 drone
- 02.03 jazz
- 02.04 math rock
- 02.05 no wave
- 02.06 noise
- 02.07 noise rock
- 02.08 psychedelic

03 Hip-Hop/Soul/RnB

- 03.00 hip-hop
- 03.01 dirty south
- 03.02 east coast rap
- 03.03 gangsta rap
- 03.04 rap
- 03.05 rnb
- 03.06 soul
- 03.07 southern rap
- 03.08 underground hip-hop
- 03.09 underground rap
- 03.10 west coast rap

04 Indie/Alternative

- 04.00 indie
- 04.01 alternative
- 04.02 alternative rock
- 04.03 britpop
- 04.04 electro-acoustic
- 04.05 folk
- 04.06 hamburger schule
- 04.07 indie pop
- 04.08 indie rock
- 04.09 lo-fi
- 04.10 new weird caledonia
- 04.11 post-punk
- 04.12 shoegaze

05 Pop/Disco/Funk

- 05.00 pop
- 05.01 disco
- 05.02 dreamgaze
- 05.03 funk
- 05.04 party punk
- 05.05 teen pop
- 05.06 ye-ye

06 Rock Music

- 06.00 rock
- 06.01 blues
- 06.02 blues rock
- 06.03 classic rock
- 06.04 emo
- 06.05 garage rock
- 06.06 hard rock
- 06.07 loungecore
- 06.08 metal
- 06.09 ostrock
- 06.10 power rock
- 06.11 progressive rock
- 06.12 punk
- 06.13 punk rock
- 06.14 wizard rock

07 Singer/Songwriter

- 07.00 singer-songwriter
- 07.01 acoustic rock
- 07.02 americana
- 07.03 country
- 07.04 electrofolk
- 07.05 mellow rock
- 07.06 progg

Independent variables: (Related) Variety

Top/Bottom 5 (Avg. per time period)

Entropy at different levels every 5 years

$$P_g = \sum_{i \in S_g} p_i$$
 Probability of artist to be tagged with genre belonging to a group of genres on certain level of aggregation

Unrelated Variety (across streams [2-digit level])

$$UV_{mt} = \sum_{k=1}^7 P_{kmt} \ln \left(\frac{1}{P_{kmt}} \right)$$

Semi-related variety (4-digits within streams)

$$SRV_{mt} = \sum_{l=1}^{79} P_{lmt} \ln \left(\frac{1}{P_{lmt}} \right) - \sum_{k=1}^7 P_{kmt} \ln \left(\frac{1}{P_{kmt}} \right)$$

Related variety (all genres within 4-digit levels)

$$RV_{mt} = \sum_{i=1}^{919} P_{imt} \ln \left(\frac{1}{P_{imt}} \right) - \sum_{l=1}^{79} P_{lmt} \ln \left(\frac{1}{P_{lmt}} \right)$$

Unrelated Variety (UV)

#	City	Value	#	City	Value
1	New York City	1.67	29	Boston	1.15
2	Paris	1.65	30	Leeds	1.05
3	Washington	1.65	31	Portland	1.03
4	Barcelona	1.57	32	Seattle	0.97
5	Miami	1.56	33	Bristol	0.94

Semi-related Variety (SRV)

#	City	Value	#	City	Value
1	London	1.73	29	Baltimore	1.02
2	San Francisco	1.66	30	Nashville	0.87
3	Los Angeles	1.60	31	Montreal	0.85
4	Portland	1.57	32	New Orleans	0.76
5	New York City	1.52	33	Barcelona	0.71

Related Variety (RV)

#	City	Value	#	City	Value
1	Chicago	1.09	29	Minneapolis	0.38
2	New York City	1.01	30	Glasgow	0.38
3	Los Angeles	1.00	31	Liverpool	0.32
4	San Francisco	0.88	32	Sheffield	0.30
5	Boston	0.88	33	Manchester	0.28

Independent variables: Specialization/Relatedness

Top/Bottom 5 (Avg. per time period)

Specialization coefficient

$$SC_m = \frac{1}{2} \sum_{i=1}^I \left| \frac{f_{im}}{F_m} - \frac{F_i}{F} \right|$$

f_{im} = Frequency of local bands tagged with genre i

Average relatedness of ties

$$AR_m = \frac{\sum CM_m R}{\sum CM_m}$$

CM_m = Co-occurrence matrix of music scene

R = Relatedness matrix between all genres

Specialization Coefficient (SC)

#	City	Value	#	City	Value
1	Barcelona	0.65	29	Chicago	0.41
2	Bristol	0.63	30	London	0.37
3	Nashville	0.62	31	San Francisco	0.32
4	Seattle	0.61	32	New York City	0.28
5	Gothenburg	0.61	33	Los Angeles	0.24

Average Relatedness (AR)

#	City	Value	#	City	Value
1	Barcelona	0.15	29	Glasgow	0.10
2	Minneapolis	0.15	30	Manchester	0.10
3	Memphis	0.14	31	Baltimore	0.09
4	Houston	0.14	32	Gothenburg	0.09
5	Seattle	0.14	33	Berlin	0.08

Dependent variables: Innovation in music

New Genres

Genre appearing for the first time in the data after 1969 at Y_x , users tagged > 30 artists (n=117)

Pioneers

Artists from city tagged with new genre & founded at Y_E between Y_x and Y_{x+4} (n=661)

Combinators

Artists from city combining genres that were previously uncombined globally (n=2384)

Superstars

Artists from city that have > 1 mio. listeners on last.fm (n= 385)

Descriptive Findings

New Genres			Pioneers		Combinators		Superstars	
Rank	City	Value	City	Value	City	Value	City	Value
1	New York City	57	New York City	140	New York City	377	London	66
2	London	40	London	110	London	317	New York City	65
3	Los Angeles	33	Los Angeles	73	Los Angeles	302	Los Angeles	64
4	San Francisco	29	San Francisco	37	Chicago	119	Chicago	14
5	Chicago	22	Chicago	36	San Francisco	113	Atlanta	14
29	Gothenburg	3	Liverpool	5	Sheffield	23	Minneapolis	1
30	Memphis	3	Montreal	4	Leeds	22	Liverpool	1
31	Barcelona	3	New Orleans	3	Houston	21	Memphis	1
32	New Orleans	2	Barcelona	2	Nashville	21	Hamburg	0
33	Nashville	1	Nashville	1	Memphis	20	Barcelona	0

Relation between variety and innovation in music scenes

Correlation Matrix of dependent and independent variables

	Combinators	Superstars	Pioneers	New Genres	SC	AR	UV	SRV	RV
Superstars	0.81 ***								
Pioneers	0.49 ***	0.45 ***							
New Genres	0.42 ***	0.40 ***	0.92 ***						
SC	-0.43 ***	-0.30 ***	-0.15 **	-0.11					
AR	0.15 **	0.11	-0.04	-0.04	-0.26 ***				
UV	0.26 ***	0.16 **	0.12 *	0.09	-0.48 ***	0.23 ***			
SRV	0.41 ***	0.29 ***	0.14 *	0.08	-0.73 ***	0.29 ***	0.27 ***		
RV	0.43 ***	0.29 ***	0.21 ***	0.17 **	-0.56 ***	0.23 ***	0.30 ***	0.32 ***	
No. of artists	0.74 ***	0.56 ***	0.22 ***	0.16 ***	-0.57 ***	0.18 **	0.30 ***	0.46 ***	0.49 ***

Test of relation between variety and innovativeness of urban music scenes:

- Independent variables (variety) measured every five years (1970-2015)
- Dependent variables (innovation) aggregated over 5-year time intervals (70-74, ...)

- Balanced panel data, 297 observations (33 cities, 9 time periods)
- Calls for time-fixed effects model
- Controlled for size of music scene (No. of artists)

Regression Results

Estimates of time-fixed-effects regressions

Independent variables	Dependent variables			
	COMBINATORS	SUPERSTARS	PIONEERS	NEW GENRES
Specialisation coefficient	-7.0299586 (4.4187)	-3.277298 (1.2366) **	-9.553893 (2.7670) ***	-6.0849471 (1.3937) ***
Average Relatedness	-5.8071654 (13.9413)	2.126799 (3.9015)	-10.551481 (8.7301)	-2.5342990 (4.3971)
Unrelated Variety	0.7125841 (1.5986)	-0.143912 (0.4474)	1.387193 (1.0010)	0.5628447 (0.5042)
Semi-related Variety	4.1902137 (1.5303) **	0.888623 (0.4283) *	3.82264 (0.9583) ***	2.0695406 (0.4827) ***
Related Variety	3.0944678 (1.6704) .	-0.089919 (0.4675)	1.560873 (1.0460)	0.6820412 (0.5269)
No. of artists	0.0769125 (0.0042) ***	0.013144 (0.0012) ***	0.006981 (0.0026) **	0.0026377 (0.0013) *
Adj. R ²	0.66	0.44	0.28	0.32
p-value	<0.00000	<0.00000	<0.0000	<0.0000

Estimates for time-fixed effects regressions (oneway), standard errors in parentheses, lagged independent variables

(***) $p < 0.001$, (**) $p < 0.01$, (*) $p < 0.05$, (.) $p < 0.1$

Balanced Panel: $n=33$, $T=9$, $N=297$

Conclusions

- Methods for analysis of technological knowledge base transferable
- Use of user-generated (geographic) information in other areas where patents/industry classification do not work?
- Specialization: Negative for emergence of new genres
- Unrelated Variety: Too much of a good thing
- Semi-related variety: Positively linked to all aspects of innovation
- Related variety: Positively linked to new combinations
- ❖ Path-dependency limits creativity in creative industries
(Music scenes arise from innovation, but are unfavourable for innovation?)
- ❖ SRV & RV promote innovation by combination
- ❖ A „broad focus“ promotes innovation in music/(creative industries?)
- ❖ Symbolic knowledge creation also linked to related variety

PLAYLIST

Innovation in Music: Boston

Artists from Boston that were pioneers of new genres, made new combinations between genres or have > 1 Million listeners on last.fm

Created by: **Benjamin Klement** • 105 songs, 6 hr 17 min

PLAY



Or click this link:

<https://open.spotify.com/user/1121774206/playlist/3oR8UakZxbRs7RFJ98qT7V>

Scan QR code
to play



THANKS FOR YOUR ATTENTION!

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RESEARCHGATE: [HTTP://BIT.LY/BKLEMENT RG](http://bit.ly/bklement_rg)

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