

A Comparison of Question Intonation Patterns and Melodic Profile in Songs

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- Overview
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Introduction

- Several different question types in English language
- Linguists model common intonation patterns
- What about music?
- Do these patterns correlate with musical melodies?
- Do certain melodies make people write songs with question in them?
- Or vice versa?

- MIR (Automated Transcription)
- Psychoacoustics (Psychology of Melody)
- Linguistics (Language Comparison)
- Musical Psychology (Perceptual Evaluations of Lyrics and Music)
- Cognitive Psychology (Learning Based Models)





Hypothesis

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The general intonation patterns of questions within speech and music are the same.

- Produce data set of popular British English music with questions occurring in them.
- Extract just the question from songs.
- Capture the f_0 of the question.
- Graph all intonation patterns within the data set.
- Compare these intonation patterns to generalised linguistic speech intonation patterns for similarly matched question structures.

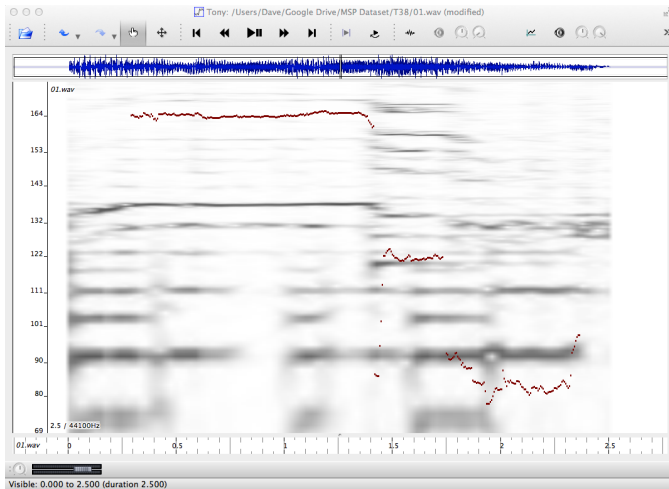
Intonation Patterns

	High Rise
	Low Rise
	Fall
	Hold

- Focus on 'Wh' and Polar questions.
- Select from British English performing bands over past 50 years.
- Finding songs with Questions.
 - Obtain Audio Tracks
 - Manually Cut Song Line
 - Identify f_0 of Lyric Melody
 - TONY (Tony, 2014)
 - Plot Intonation Patterns in MATLAB
 - Categorise based on intonation type

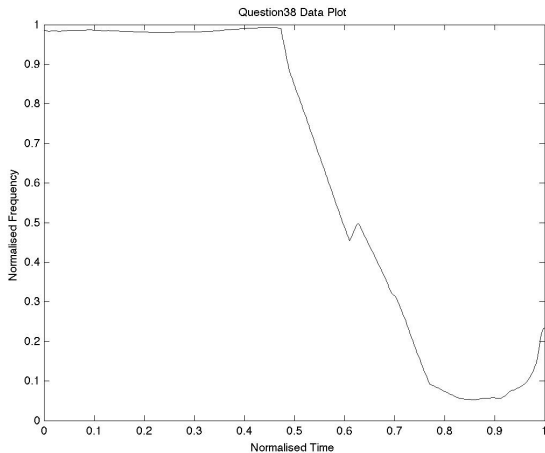
Tony (Tony, 2014)

The Who, Who Are You?, “Who Are You?”, “Wh” Question



MATLAB Plot (Tony, 2014)

The Who, Who Are You?, “Who Are You?”, “Wh” Question



Grabe et al. (2005)

“In wh-questions, the fall was more frequent and produced in 61% of the data. In polar questions, the fall was more frequent but produced in only 44% of the data.”’

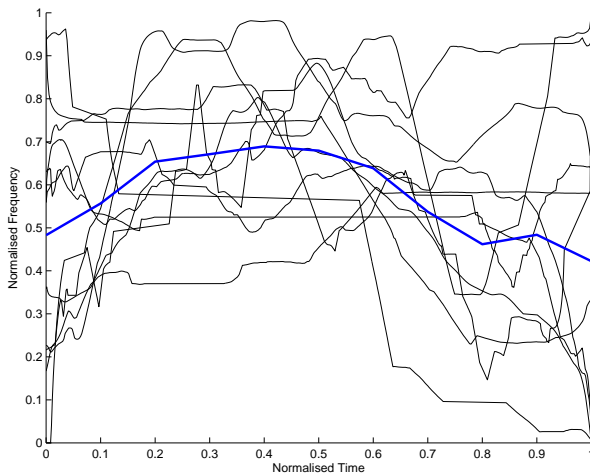
Original Project Data Set

Figure: Initial data set of songs produced as part of this project

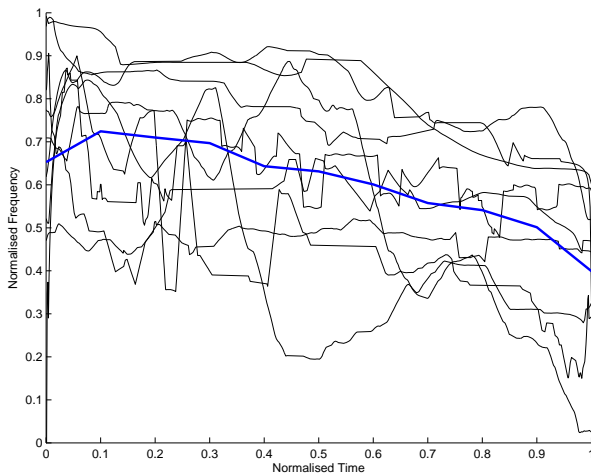
Song	Act	Line / Question	Question Type	Pitch Track
How Long	Ace	How long has this been going on?	Wh	rise-fall
But dont you remember?	Adele	But dont you remember?	Polar	rise-fall
Can you feel the love tonight?	Elton John	Can you feel the love tonight?	Polar	fall
Silent Cry	Feeder	What have I done?	Wh	low rise
Human	Killers	Are we human or are we dancers?	Wh	rise-fall
How can anybody possibly know how I feel?	Morrissey	How can anybody possibly know how I feel?	Wh	hold
Dyou know what I mean?	Oasis	Dyou know what I mean?	Polar	fall
Do you remember?	Phil Collins	Do you remember?	Polar	rise-fall
Do you remember the first time?	Pulp	Do you remember the first time?	Polar	fall
Who want to live forever?	Queen	Who want to live forever?	Wh	rise-fall
Bohemian Rhapsody	Queen	Is this the real life	Polar	fall
Bohemian Rhapsody	Queen	Is this just fantasy	Polar	fall
Who do you think you are?	Spice Girls	Who do you think you are?	Wh	fall-rise
Why dont we do it on the road?	The Beatles	Why dont we do it on the road?	Wh	fall
Who are you?	The Who	Who are you?	Wh	fall
Why does it always rain on me?	Travis	Why does it always rain on me?	Wh	fall

- Ended up with a dataset of 50 songs

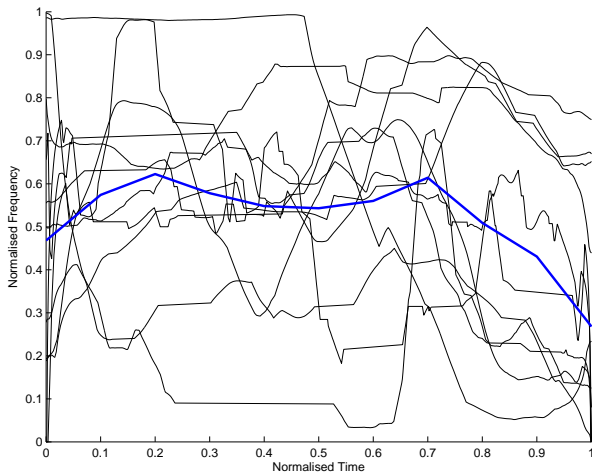
Mean Pitch of Falling Intonation for 'Wh' Questions



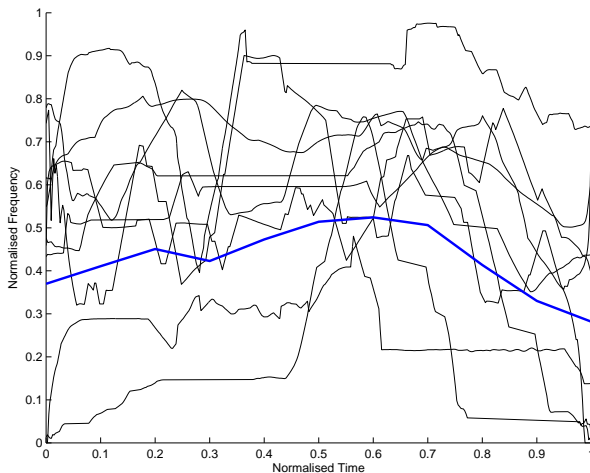
Mean Pitch of Falling Intonation for Echo Questions



Mean Pitch of Rising Falling Intonation for 'Wh' Questions



Mean Pitch of Rising Falling Intonation for Echo Questions



Results

Table: Classification of sung melodic profiles corresponding to questions in lyrics sorted by question types (absolute numbers)

Question Type	Rise-Fall	Fall-Rise	Fall	Other	Total
Wh-question	11	6	5	3	25
Yes/ No questions	11	2	7	5	25
All Questions	22	8	12	8	50

Table: Classification of sung melodic profiles corresponding to questions in lyrics sorted by question types (percentages)

Question Type	Rise-Fall	Fall-Rise	Fall	Other
Wh-question	44%	24%	20%	12%
Yes/ No questions	44%	8%	28%	20%
All Questions	44%	16%	24%	16%

Results - From the Literature

Table: Speech intonation patterns for different questions (reproduced from (Grabe et al., 2005))

	Rise-Fall	Fall-Rise	Fall	Rise	Hold	Total
Wh-Question	18	133	99	56	0	306
Yes/No Question	0	86	61	84	0	231

- Performed Statistical Analysis on Results
- Used χ^2 to show correlations between melody and speech.
- Produced p-values -probability of these results correlating by chance.
- P-values for both question types less than 0.01%

Hypothesis

The general intonation patterns of questions within speech and music are the same.

- Our hypothesis has been proved correct, with a probability of 99.99%
- The results are statistically significant
- This is entirely new research, nobody has ever shown these correlations before.

Further Work

- Study based on songwriters' dialect, to determine if composed melodies follow suit.
- Review of Melody first or lyric first as results
- Comparison between different musical genres.
- Comparison between different languages.
- Other speech intonation patterns.

References I

- Jan Roelof De Pijper. *Modelling British English Intonation*, volume 3. Walter de Gruyter, 1983.
- Esther Grabe, Greg Kochanski, and John Coleman. The intonation of native accent varieties in the British Isles: potential for miscommunication. *English pronunciation models: a changing scene*, pages 311–338, 2005.
- Daniel Hirst. Intonation in British English. *Intonation Systems. A Survey of Twenty Languages*, 56:77, 1998.
- Linh Thuy Huynh. Question intonation patterns in a real-life conversation and in textbook dialogs. *TESOL Working Paper Series*, 10:83–92., 2012.
- Tony. *a tool for melody annotation, version 0.4*. Mauch, Matthias and Dixon, Simon, Queen Mary University London, 2014.
- Robert J Zatorre and Shari R Baum. Musical melody and speech intonation: singing a different tune. *PLoS biology*, 10(7):e1001372, 2012.

Questions?