

Digital Music Lab

An AHRC Digital Transformations Project

The Temperament Police

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Background

- ▶ $(3/2)^{12} > 2^7$
 - ▶ life is tough...
- ▶ Much scholarly work about what **should** be done
- ▶ Very little (if any) about what **is** being done
 - ▶ until...



Relevant publications

Relevant publications

- D. Tidhar, M. Mauch, and S. Dixon **High Precision Frequency Estimation for Harpsichord Tuning Classification**, IEEE International Conference on Acoustics, Speech and Signal Processing, 2010.
- D. Tidhar, M. Mauch, G. Fazekas, and S. Dixon **TempEst - Harpsichord temperament estimation in a Semantic Web environment**, Journal of New Music Research 39 (4), 2011.
- S. Dixon, D. Tidhar, and E. Benetos **The Temperament Police: The Truth, the Ground Truth and Nothing but the Truth**, 12th International Society for Music Information Retrieval Conference, 2011.
- S. Dixon, M. Mauch, and D. Tidhar **Estimation of Harpsichord Inharmonicity and Temperament from Musical Recordings**, Journal of the Acoustical Society of America, 131 (1), Jan 2012.
- D. Tidhar, S. Dixon, E. Benetos, and T. Weyde **The Temperament Police**, Early Music, November 2014.

Technical challenges

- ▶ Ground truth
 - ▶ no source is truly reliable
- ▶ Transcription
 - ▶ no prior knowledge of the score
- ▶ Frequency estimation
 - ▶ high resolution necessary



Temperament Police (ISMIR 2011)

- Enhanced system:
 - Recent state-of-the-art transcription component
 - Temperament profiles generated to cover all mentioned temperaments
- Applied to a collection of over 500 tracks from CDs which specify temperament information
- **NOT** a "name and shame" system
- Survey aimed to facilitate conclusions about this aspect of performance practice

Traffic light?

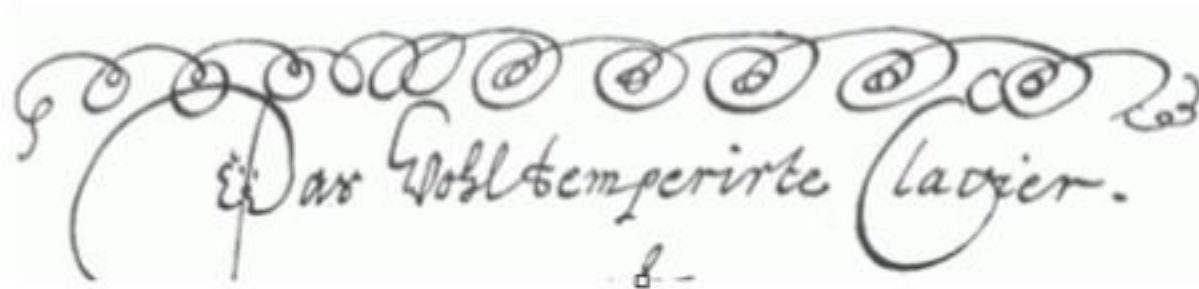
CD's	Notated	Estimated
24	Bach-Lehman	Bach-Lehman
4, 6, 23	1/5-comma meantone	1/5-comma meantone
5, 20	1/4-comma meantone	1/4-comma meantone
11	Neidhardt	Neidhardt
18	Werckmeister III	Werckmeister III
2	1/5-comma meantone	various
22	Werckmeister III	various
1	Ordinaire	1/6-comma meantone
3	1/6-comma meantone	1/5-comma meantone
4, 19, 21	1/4-comma meantone	1/5-comma meantone
6, 7	Late 17 th century	Vallotti
8	Late 17 th century	Kimberger III
12	Werckmeister III	Kellner
14, 15	Kimberger III	Neidhardt



DML - Temperament

Temperament Estimation

- ▶ Temperament Police
 - ▶ Dataset enlarged to > 2000 tracks
 - ▶ Methods enriched with collection-level analysis



592

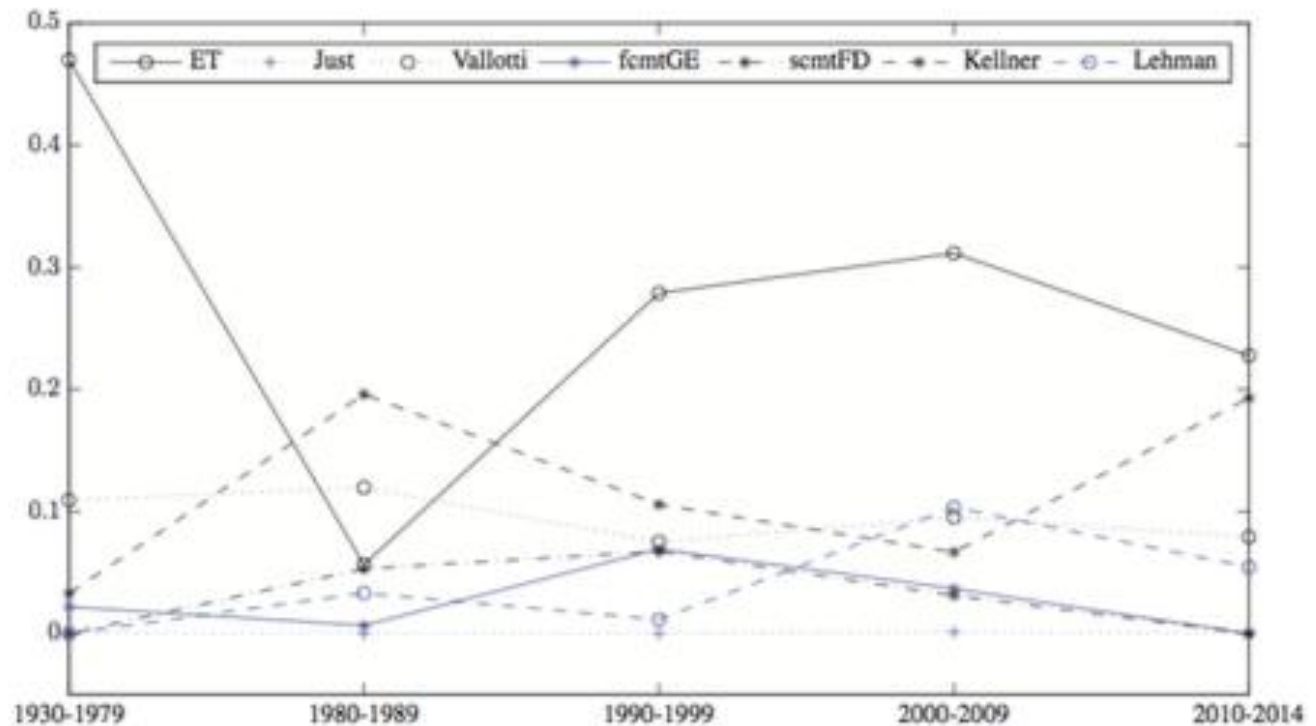
Temperament Police (Early Music 2014)



Police II - consistency

<i>Set of track pairs</i>	<i>Average distance</i>
All track pairs	22.7
Track pairs within CD	14.6
Successive tracks	11.5
Track pairs within piece	10.8

Police II - trends



3 Trends in popularity of some selected temperaments as reflected in relative number of occurrences in the dataset across decades. These include equal temperament (ET), just intonation (Just), Vallotti, fifth-comma meantone with a $G^{\sharp}-E^{\flat}$ wolf (fcmtGE), sixth-comma meantone with an $F^{\sharp}-D^{\flat}$ wolf (scmtFD), Kellner and Lehman's 'Bach' temperament.

Police II - Particular pieces: WTC1

Gustav Leonhardt	1973
Christiane Jaccottet	1989
Bob van Asperen	1999
Gary Cooper	2000
Ottavio Dantone	2001
Peter Watchorn	2006

Police II - Particular pieces: Goldberg Variations

Wanda Landowska	1933 (1999 remaster)
Gustav Leonhardt	1965
Gustav Leonhardt	1978
Kenneth Gilbert	1987
Ton Koopman	1988
Lars Ulrik Mortensen	1989
Richard Egarr	2006
Matthew Halls	2007
Yoshiko Ieki	2007
Barbara Dobozy	2009
Aapo Hakkinen	2010
David Shemer	2011

Ongoing/future work

- ▶ Data Data Data
- ▶ More elaborate “police” analysis: e.g. what kind of deviations are “permissible”?
- ▶ More elaborate trend analysis
- ▶ Extend to other instruments

