Psychological aspects of singing development in children

Professor Graham F Welch
Institute of Education, London

Introduction

Phases of physical vocal development across the lifespan

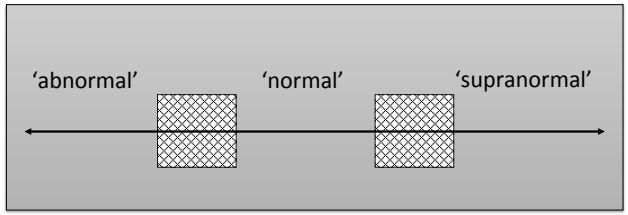
- Early Childhood 1-3 years
- Later Childhood 3-10 years
- Puberty 8-14 years
- Adolescence 12-16 years
- Early Adulthood 15-30/40 years
- Older Adulthood 40-60 years
- Senescence 60-80+ years

- Often overlap between phases
- Difference between biological age *versus* chronological age
- Sex differences
- Individual differences

Phases of physical vocal development across the lifespan

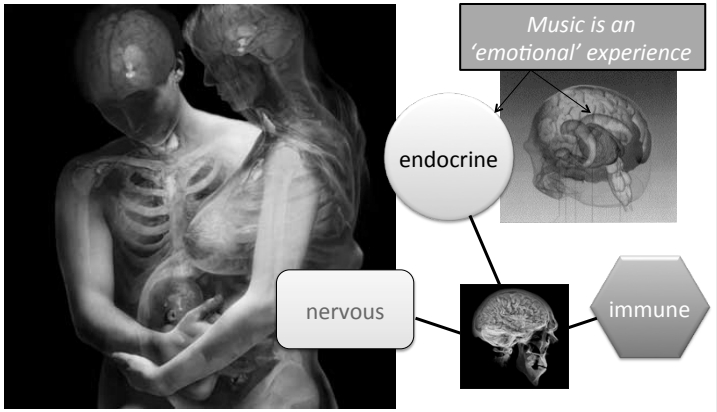
- Difference between biological age *versus* chronological age
- Sex differences
- Individual differences

A continuum of vocal ability



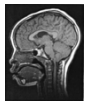
(Welch, in press)

Neuropsychobiological design and music: the 'bodymind' (Pert, 1986; Thurman & Welch, 2000; Welch, 2005)

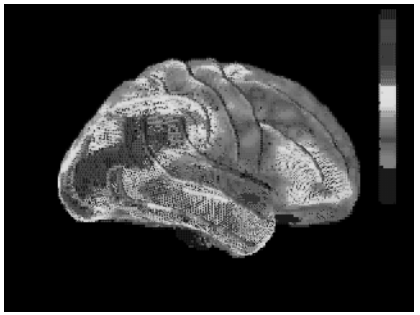


Tsiaras (2005)

Brain Architecture and Singing



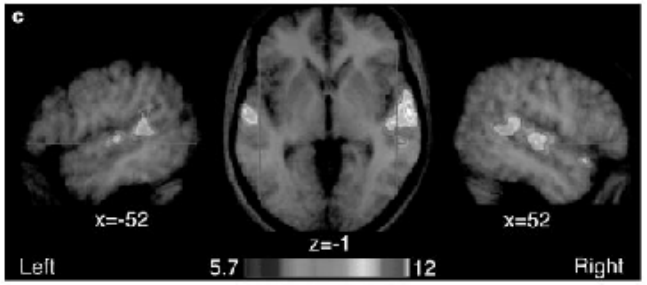
Brain Architecture



ICBM International Consortium for Brain Mapping
http://www.loni.ucla.edu/ICBM/

The brain has an integrated neurological modularity

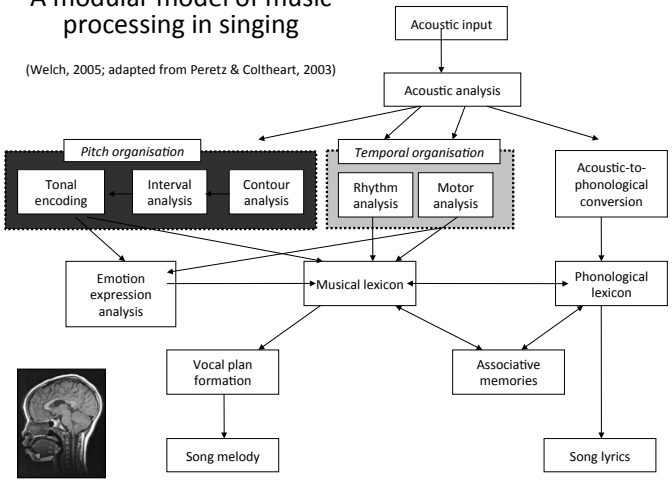
For example – both sides of the brain are involved in the analyses of human speech



Belin *et al* (2000) Voice-selective areas in the human auditory cortex. *Nature*. 403: 309-312.

A modular model of music processing in singing

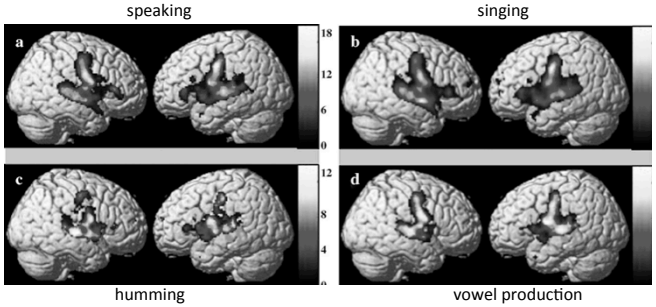
(Welch, 2005; adapted from Peretz & Coltheart, 2003)



Speech and singing

There is 'a bi-hemispheric network for vocal production, regardless of whether the words/phrases are intoned or spoken'

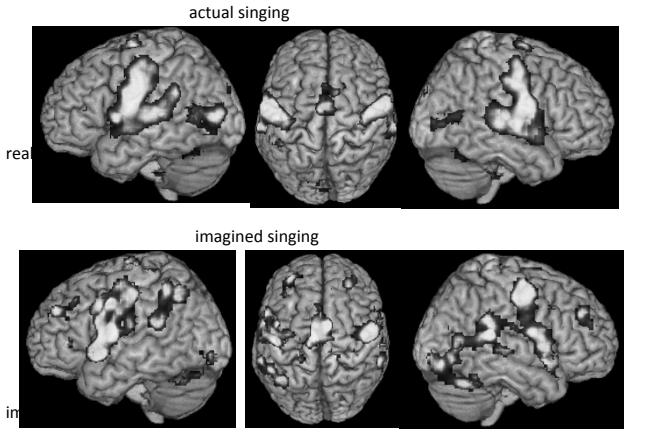
Task: to imitate a sequence of 20 bi-syllabic words/phrases commonly used in everyday life based on auditory stimuli previously recorded by a native speaker of English



(all conditions versus silence)

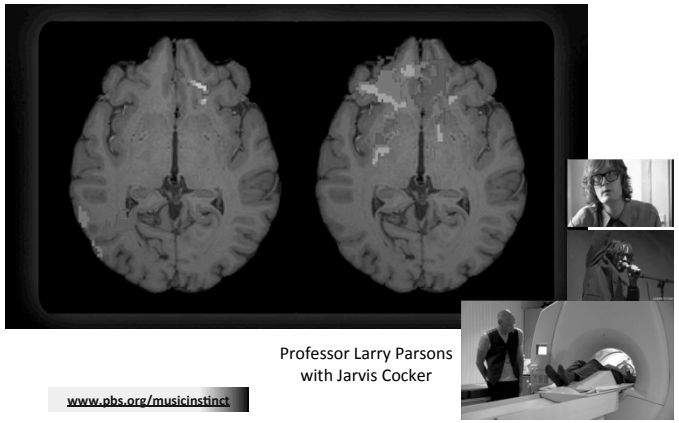
Özdemir et al, 2006

Neurological basis for real and imagined singing



Kleber et al (2007)

Neurological differences in singing alone or with others



Professor Larry Parsons with Jarvis Cocker

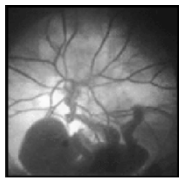
www.pbs.org/musicinstinct

Childhood

Musical development begins pre-birth

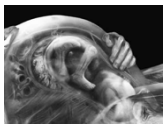
Acoustic links

Prosodic and melodic features of mother's voice (speaking & singing) are perceived *in utero*



foetus

mother



Mother's emotional state when vocalising (speaking & singing) is 'encoded' hormonally in the filtered interfacing of the mother's and foetus' bloodstreams

Hormonal links

(Welch, 2005)

Foetal experiences of music

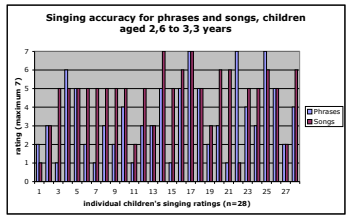
www.pbs.org/musicinstinct

Early Childhood (1)

- identifiable rhythmic and melodic contour patterns
- 3-year-olds' have vocal interplay between spontaneous improvisation and selected elements from the dominant song culture
  - 'pot-pourri' songs
  - 'outline songs' (Hargreaves, 1996)

Early Childhood (2)

- development is not necessarily linear for any particular individual
- USA study of spontaneous singing of two-year-olds' first songs - evidence that *'phrases are the initial musical units'* (Davidson, 1994, p117)
  - –
  - –
    tonality and
  - – a descending contour



- Recent longitudinal Italian data of two- and three-year-olds reveals impact of rich singing environment from pre-birth
- Some children able to imitate *complete* songs modelled by their mothers by age 3

(Tafuri & Welch *in* Welch, 2006; Tafuri, 2009)

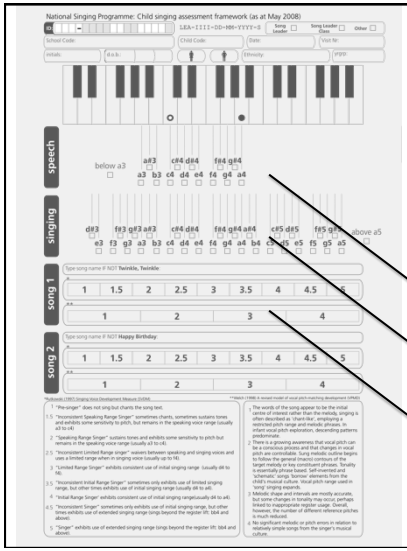
Sing Up – national impact evaluation: Schools, Pupils and Assessments (2007-2010)

- 177 schools
- 9,979 pupils (51.8% female) (Primary aged)
- 11,388 individual singing assessments

Across the opening three years of the Sing Up impact research evaluation

sing up
Help Kids find their Voice

(Data to 10 August 2010)



Children's speaking and singing behaviours and development

(both mainstream and special schools)

Individual child

Familiar space in school

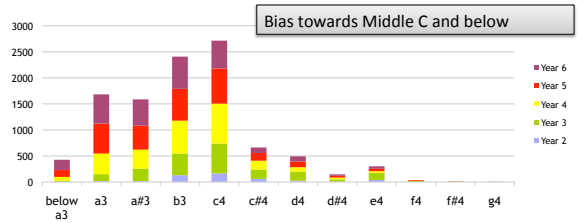
Count backwards from 10 or 20

Echo simple pitch glides, up and down

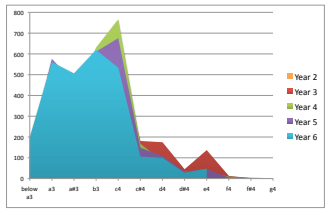
Sing 2 well-known songs (assessed against 2 rating scales)

Children's speaking

Children's spoken pitch (1)

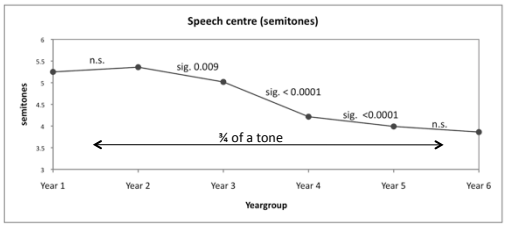


C^4 = Middle C

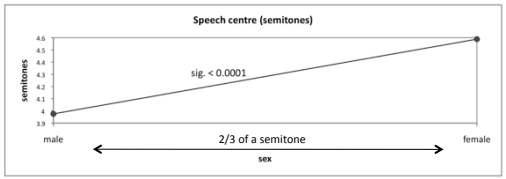


Gradual shift downwards
in spoken pitch
(= to the left in the graphic)
as children get older

Children's spoken pitch (2) (2007-9 data)

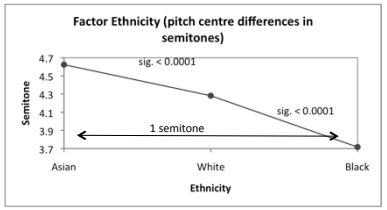


age

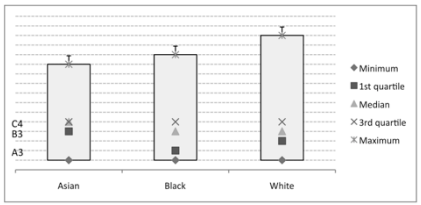


sex

Children's spoken pitch (3) (2007-9 data)

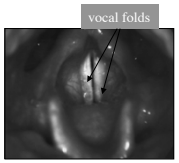


Ethnicity
(difference in pitch
is related to the size
of the vocal instrument)



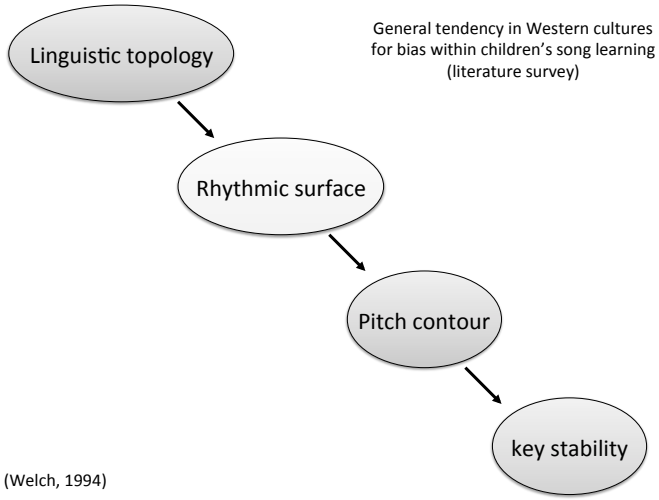
Children's spoken pitch overview

- from age 5+ to 10+
  - i.e., the *vocal folds* elongate and pitch goes down
- Girls have higher average speaking voices (by 2/3 of a semitone)
  - indicating slightly smaller *vocal folds,* on average, compared to boys
- Asian children have slightly smaller *vocal folds*, on average, compared to other major ethnic groups (and white < black) – but only one semitone difference covers all three groups in mean spoken pitch production



(Welch et al 2009)

Children's singing



General tendency in Western cultures for bias within children's song learning (literature survey)

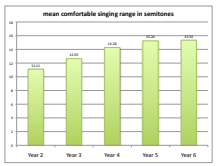
(Welch, 1994)

Comfortable mean singing range & age

year 3
year 4
year 5
year 6

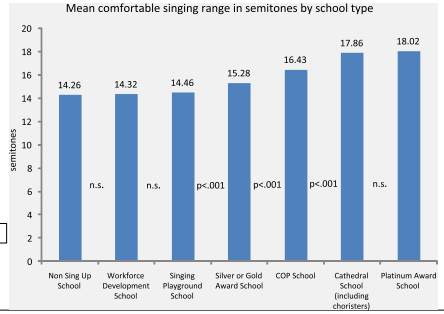
Age 7
g^3 to c^5 (approximately one and a half octaves)

Age 10
f^3 to e_b^5 (almost two octaves)



- sig diff age (p<.001), except between School Years 5 and 6
- sig diff sex f>m (p<.001)

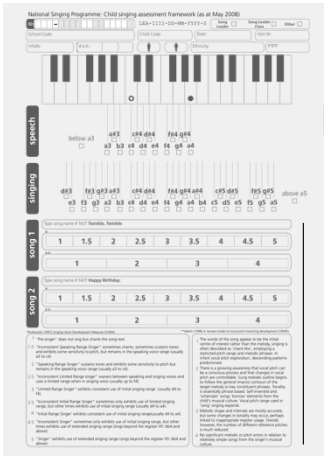
Comfortable mean singing range by school type



$F(65,11215) = 36.253$, $p<.0001$

- Children who had experienced an extended programme of singing development, such as in the Sing Up Award Schools and Chorister Outreach Programme (COP) tended to have the largest comfortable singing ranges – as measured in semitones.

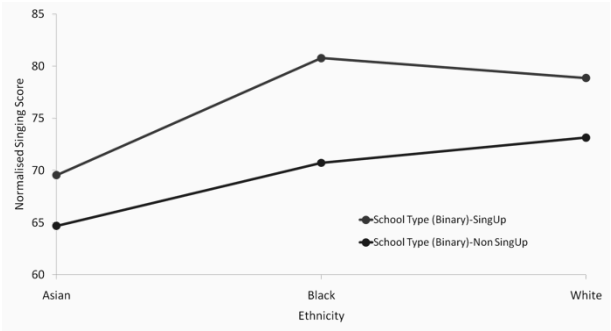
'Normalised' singing score



Each child:

- 2 songs
- 2 ratings per song
- All ratings aggregated into one 'score'
- Maximum overall rating = 100%

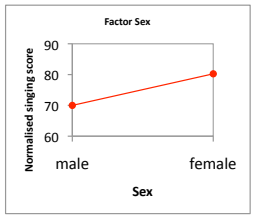
Singing development & ethnicity



(Black = White) > Asian

Sing Up > Non-*Sing Up*

Singing development & sex

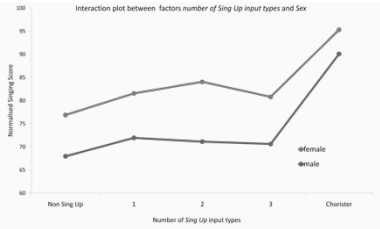


girls > boys

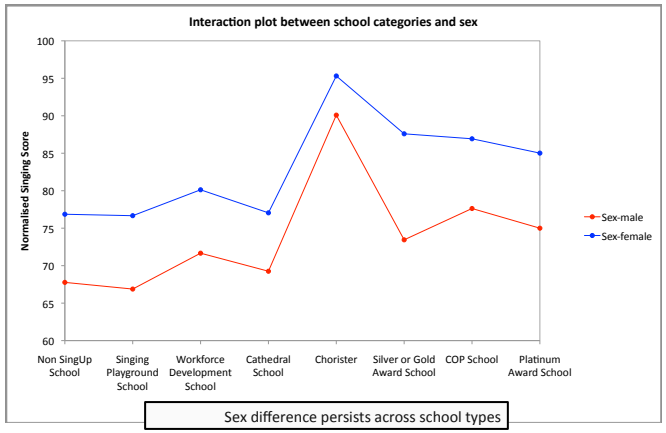
Sig. p<.001

Sex difference persists despite number of Sing Up interventions

But not significant for choristers

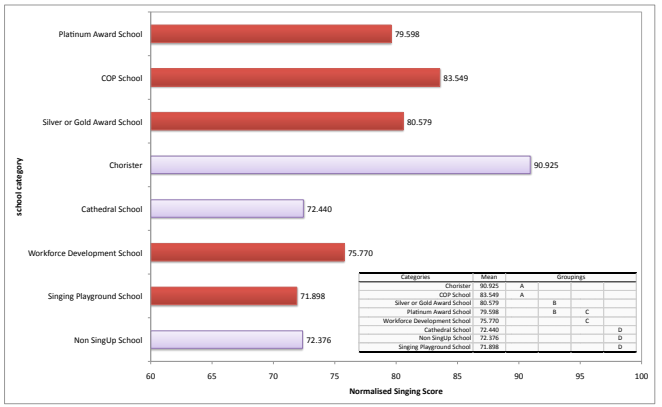


Singing development, sex & school type



Sex difference persists across school types

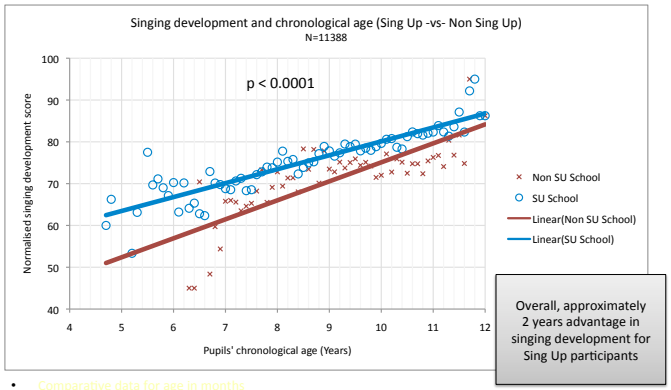
Singing development & school type



= Sing Up school types

= Non-Sing Up school types

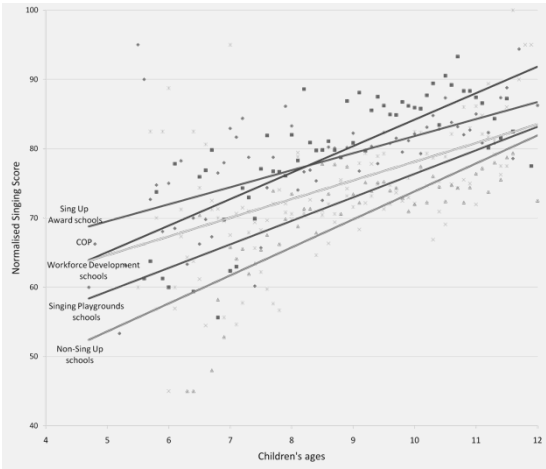
Children's Singing Development: Impact of *Sing Up*



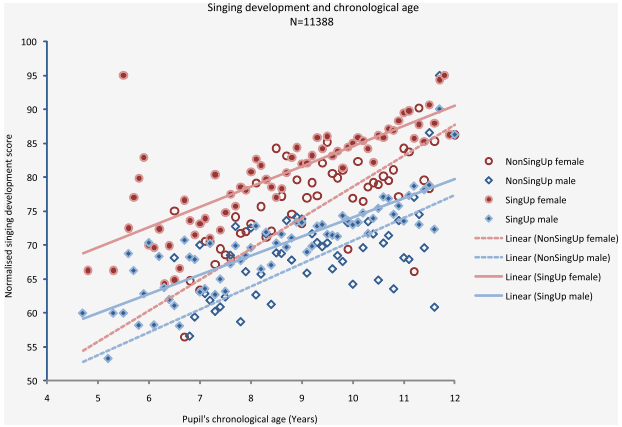
Overall, approximately 2 years advantage in singing development for Sing Up participants

- Comparative data for age in months
- The number of ratings on the database is 11,388 (10 August 2010) for 9,979 children.
- A normalised singing development score of 100 is very competent singing (such as typically exhibited by our Cathedral choristers).
- A score of 50 is much less developmentally advanced.

Children's singing development: Impact of Sing Up by school category

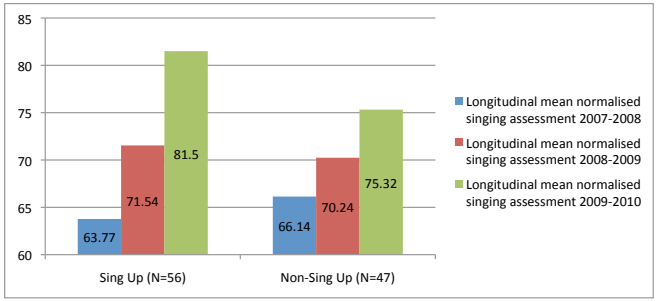


Singing development, age, sex and Sing Up



Welch *et al*, 2011

Longitudinal data & school type (1)



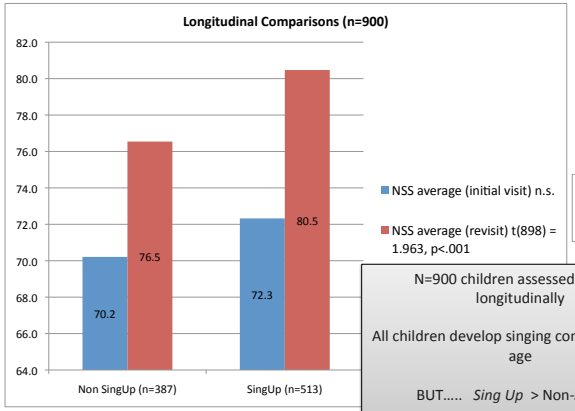
N=103 children assessed 3 times longitudinally

All children develop singing competency with age

But..... *Sing Up* > Non-*Sing Up* sex n.s.

($F(1,101) = 28.51$, $p<.001$)

Longitudinal data & school type (2)



N=900 children assessed 2 times longitudinally

All children develop singing competency with age

BUT..... *Sing Up* > Non-*Sing Up*

- Both girls and boys

($F(1,898) = 143.26$, $p<.001$)

Singing development & schools

- *Up*
of the overall ranking of schools currently on the database (n=177).

- In contrast, Non-*Sing Up* schools, including the non-choristers in Cathedral schools, tend to be distributed more towards the bottom quartile.

	% schools	
	NSU	SU
upper quartile	13	87
lower quartile	43	57

$X^2 = 18.52$, $p<.001$

Upper quartile

School	Average of Normalized score	NSP1	NSP2	NSP3	% of pupils are FEMALE	Other	Asian	Black	Chinese	Mixed	White	Number of assessments
Greater London [School ID: 22]	99.44				0%	0%	0%	6%	0%	0%	94%	18
Devon [School ID: 70]	96.34		✓	✓	86%	0%	3%	7%	0%	0%	90%	29
Greater Manchester [School ID: 116]	95.04			✓	93%	0%	0%	10%	0%	0%	90%	30
Devon [School ID: 64]	95.04		✓	✓	74%	0%	0%	0%	0%	0%	100%	31
Devon [School ID: 69]	94.74		✓	✓	79%	0%	0%	0%	0%	0%	100%	19
Wiltshire [School ID: 133]	93.72			✓	51%	0%	0%	0%	0%	0%	100%	47
Devon [School ID: 68]	92.83		✓	✓	89%	0%	0%	0%	0%	0%	100%	19
Devon [School ID: 67]	92.60		✓	✓	60%	0%	15%	0%	0%	0%	85%	13
Cambridgeshire [School ID: 45]	92.18			✓	97%	0%	0%	0%	0%	0%	100%	39
Devon [School ID: 62]	92.03		✓	✓	94%	0%	0%	0%	0%	0%	100%	16
Essex [School ID: 58]	92.01	✓	✓	✓	100%	0%	0%	2%	0%	2%	96%	51
Wiltshire [School ID: 134]	91.71	✓	✓	✓	69%	0%	3%	0%	0%	0%	97%	62
West Yorkshire [School ID: 8]	91.61		✓	✓	76%	0%	0%	0%	0%	0%	100%	21
Tyne and Wear [School ID: 150]	91.31		✓	✓	78%	0%	13%	4%	2%	4%	77%	45
Cambridgeshire [School ID: 44]	91.17			✓	47%	0%	0%	7%	0%	0%	93%	30
Westminster [School ID: 171]	90.73			✓	54%	0%	0%	9%	4%	9%	78%	46
Cambridgeshire [School ID: 21]	90.59	✓	✓	✓	53%	0%	2%	2%	0%	2%	95%	59
Tyne and Wear [School ID: 154]	89.75		✓	✓	86%	0%	0%	0%	0%	0%	100%	35
Tyne and Wear [School ID: 152]	89.58		✓	✓	85%	0%	3%	0%	0%	8%	90%	39
County Durham [School ID: 39]	89.53		✓	✓	91%	0%	0%	0%	0%	0%	100%	32
Cambridgeshire [School ID: 96]	89.03	✓	✓	✓	52%	0%	10%	3%	0%	10%	77%	31
Suffolk [School ID: 137]	88.75		✓	✓	46%	0%	0%	0%	0%	0%	100%	46
County Durham [School ID: 41]	87.94	✓	✓	✓	65%	0%	0%	0%	0%	0%	100%	37
Tyne and Wear [School ID: 153]	87.60		✓	✓	56%	0%	0%	0%	0%	0%	100%	39
Merton [School ID: 118]	87.18	✓	✓	✓	49%	0%	27%	9%	0%	9%	55%	55
Tyne and Wear [School ID: 37]	87.11		✓	✓	86%	0%	0%	3%	3%	0%	93%	29
Oxfordshire [School ID: 128]	87.05		✓	✓	66%	0%	13%	6%	0%	4%	77%	53
Somerset [School ID: 166]	86.54				75%	0%	0%	0%	0%	0%	100%	45
Essex [School ID: 50]	86.03	✓	✓	✓	37%	0%	1%	1%	0%	0%	98%	122
Devon [School ID: 65]	84.93		✓	✓	94%	0%	0%	0%	0%	0%	100%	18
Cambridgeshire [School ID: 17]	84.75	✓	✓	✓	50%	0%	3%	0%	0%	0%	93%	60
Greater London [School ID: 168]	84.72	✓	✓	✓	55%	1%	4%	47%	0%	21%	27%	242
Suffolk [School ID: 142]	84.69			✓	50%	0%	0%	0%	0%	0%	100%	8
North Yorkshire [School ID: 173]	84.61				50%	0%	0%	0%	0%	1%	99%	86
Kent [School ID: 93]	84.09		✓	✓	46%	0%	0%	6%	0%	0%	94%	52
Hertfordshire [School ID: 90]	83.86	✓	✓	✓	60%	0%	21%	10%	0%	5%	63%	115
Greater London [School ID: 73]	83.37				49%	0%	21%	28%	0%	7%	44%	43
Suffolk [School ID: 12]	83.27	✓	✓	✓	41%	0%	0%	0%	0%	0%	100%	34
North Yorkshire [School ID: 177]	83.19				58%	0%	6%	0%	0%	4%	90%	149
North Yorkshire [School ID: 174]	83.06				49%	0%	2%	0%	4%	0%	94%	119
County Durham [School ID: 34]	82.86		✓	✓	71%	0%	0%	0%	0%	0%	100%	28
Suffolk [School ID: 144]	82.86	✓	✓	✓	52%	0%	9%	4%	0%	5%	82%	56
Essex [School ID: 56]	82.76	✓	✓	✓	49%	0%	2%	2%	0%	0%	96%	57
Suffolk [School ID: 147]	82.70	✓	✓	✓	50%	0%	2%	6%	0%	6%	86%	50
Essex [School ID: 59]	82.65	✓	✓	✓	54%	0%	1%	2%	0%	3%	95%	117

School ratings:
Upper quartile

Number of girls equal or minority

significant ethnic minority

large school

white minority

= example variables

Children's Attitudinal data

Children's attitudinal questionnaire: 6 themes (60 questions)

1. Identity as a singer (emotional connection with singing)
2. Identity as a singer (self-efficacy)
3. Singing at home
4. Singing at school
5. Singing in informal settings
6. Self concept and sense of social inclusion



Children's attitudinal questionnaire: Overall results (n= 10,425 children)

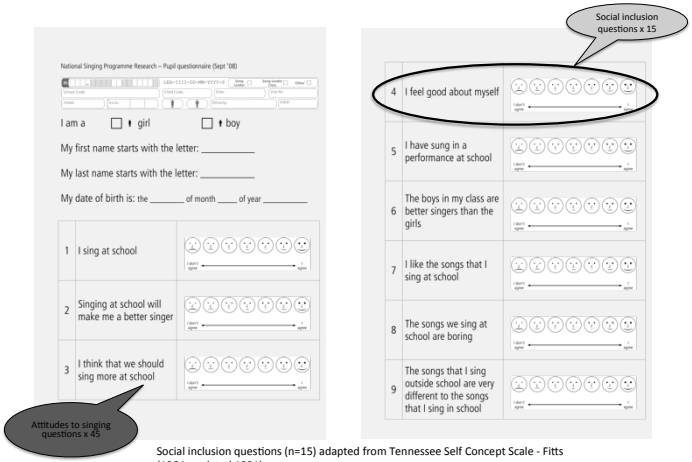
- Girls more positive than boys on all themes
- Younger children tend to be more positive than older children
- Sing Up experienced children tend to be more positive than Non-Sing Up children about singing in school (p=.001)



Why sing?

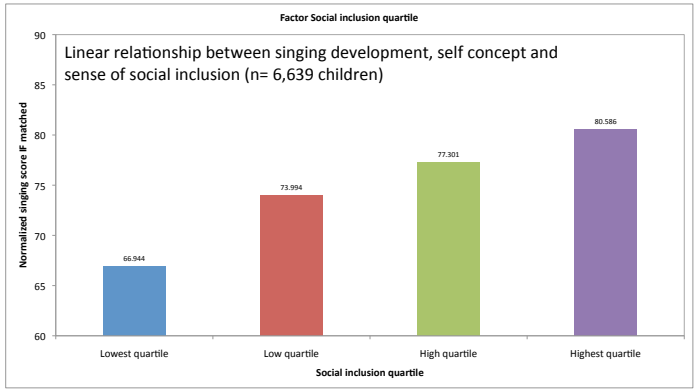
- Physical benefits
  - Respiratory (aerobic)
  - Cardiac
  - Neurological
    - Development
    - Integration
- Psychological benefits
  - Intra-personal communication
  - Catharsis
  - Inter-personal communication
- Musical benefits
  - Understanding of musical structure, phrasing
  - The development of musical memory
  - Increased expertise in vocal tone colouring, pitch, rhythm and loudness
  - Creation of a musical repertoire
- Educational benefits
  - understanding and skills about the world around us
- Social benefits
  - Group membership
  - Communication
  - Sense of community
  - Social integration

Social benefits of singing?



Social inclusion questions (n=15) adapted from Tennessee Self Concept Scale - Fitts (1964, updated 1991)

Singing development, self concept and social inclusion

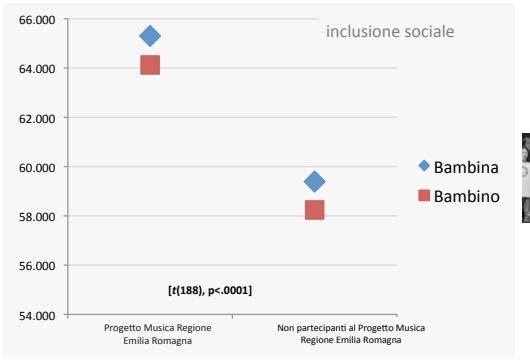


(Welch, Himonides, Saunders, Papageorgi & Rinta, 2010)

Similar data in Italy: *Progetto Musica Regione Emilia-Romagna*

Musica ed inclusione sociale

dati del questionario - bambini n=190 (bambina = 112; bambino = 78)



(Welch, Preti, Himonides & Toni, *2010)*

Neurological differences in singing alone or with others

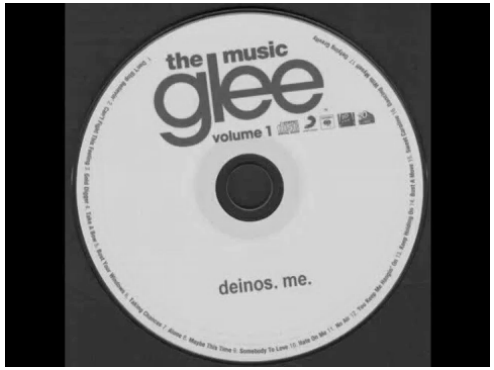
Professor Larry Parsons & Jarvis Cocker (2009)

Social impact of singing overall?

-
-

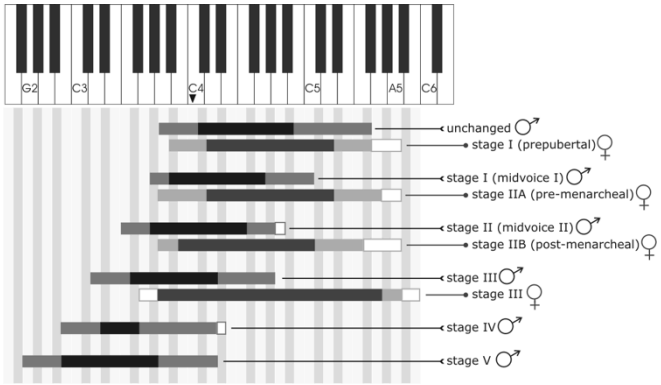
  ability to succeed
- catharsis – feeling uplifted spiritually

An example of being spiritually uplifted…



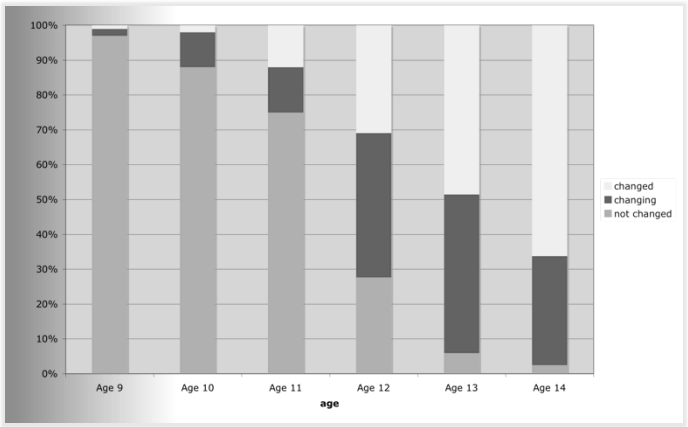
The Deaf Show Choir
performing as 'Haverbrook School for the Deaf'
in 'Glee'

Adolescence



Stages of singing voice change for
males (based on Cooksey, 2000)
females ((based on Gackle, 2000)

Welch (2006)



Extrapolated model of adolescent male voice change by age, based on UK (Geddye, 1997) and Japanese data (Norioka, 1994), Total n=3,188 adolescents

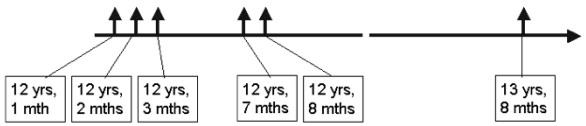
(Welch, 2006)

Speech Example

1 subject

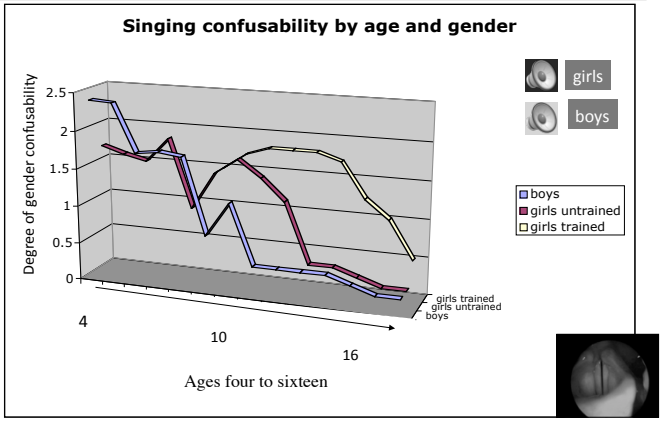
6 readings of "The Rainbow Passage"

At 6 different ages:



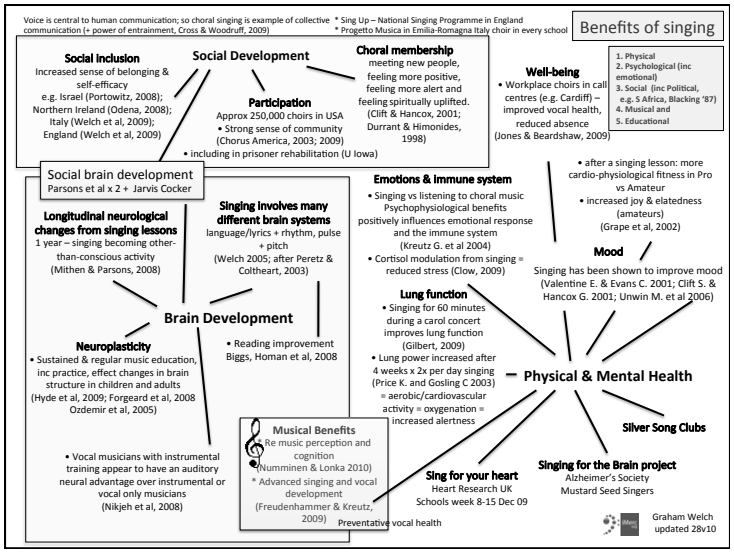
Sound file of six repeated sentences
Sjölander (2005)

- Young boys are often confused as girls
- Older boys and girls nearly always identified correctly
- But trained girls can be confused as boys



(Sergeant, Sjölander & Welch, 2005; Welch & Howard, 2002; Welch, 2006)

Benefits of singing: an overview



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g.welch@ioe.ac.uk

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