POPULAR MUSIC AS A PROBE FOR ADOLESCENT BRAIN DEVELOPMENT

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ABSTRACT

Introduction

Music and language are complex auditory sequential patterns to which the brain responds with sophistication beginning early in life. Lenneberg (1967) proposed a pre-adolescent critical period for language acquisition. Given the personal and socio-biological significance of music during adolescence, we hypothesize, in addition, an adolescent critical period for music. Enhanced plasticity for neural connections responsive to music during this period would account for lifelong preference and superior immediate recognition memory for music in styles exposed during adolescence.

Methods

In a series of related studies, listeners representing a wide range of age from childhood to senior years rated excerpts of popular music for either familiarity or liking, followed by a surprise recognition task in which half of the excerpts were new and half old. Music excerpts represented the 10 decades of popular music from 1900-2000. Decade of popularity of the music was thus uniquely linked to age cohort and provided a probe to plasticity (learnability). To control for effects of lyrics, one experiment eliminated lyrics by filtering.

Results

Preference and memory for music of a particular decade depended on an interaction of age of listener and decade of popularity of the music. Music preference was high for music to which the listener had been exposed during earlier years of life. The most memorable decades significantly differed with age cohort and reflected the proposed model of age-dependent plasticity for music grammar.

Conclusion

The results are consistent with the notion that adolescence is a period of great plasticity for acquisition of music information. This period follows that typically proposed for language acquisition. Because openness to musical style was also apparent in the pre- and early adolescents, the two critical periods (pre-adolescent and adolescent) are not necessarily mutually exclusive. Popular music may thus provide an opportunity for exploring brain development in adolescence including the establishment of rewarding behaviours, including addictions.

1. Background

- Music perception depends on the temporal cortex and cerebellum (Belin et al., 2002; Parsons, 2001), both of which undergo continuing development during adolescence (as reviewed by Dahl, 2003).
- Such brain development may enhance musical acquisition during this period
- Conversely, music acquisition during adolescence may reflect enhanced relevant brain plasticity

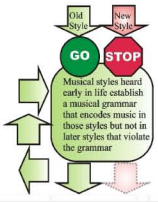
2. Language vs Music

- Both verbal language and music development
  require sensitivity to sound patterns
  require auditory memory
- Infant speech & musical productions are often indistinguishable
- Differences however in social significance
  Language needed early in life for learning & safety
  Music needed in adolescence for socialization and identity (definition of the generation, Smith, 1994)
  Music permits; language restricts

3. Hypothesis

- Music that is popular in adolescence leads to:
  (a) enduring mental representations, in contrast to transient representations for music heard later in life
  (b) a grammar for music in the adolescent-cohort-specific popular style
- Thus, throughout later life, styles consistent with that of the adolescent-period style will be
  (a) preferred
  (b) recognized more easily than styles that violate the popular music of the adolescent generation

4. Plasticity Model for Music Acquisition



5. Method

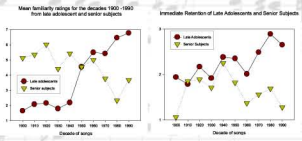
- Stimuli: 40 popular songs (1900 ~ 2000)
  ~ 15 sec/ excerpt
  4 blocks of 10 excepts
  all 10 decades per block
- Task 1: Familiarity or Preference
  Rating scale
- Task 2: Surprise Recognition
  Rating of sureness,
  did / did not just hear

6. Experiments

Experiment	Participants age (years) Child	Adolescent Early	Adolescent Late	Senior	Total *N*
1. Clyburn & Cohen (1996)			19.8	70.5	26
2. Bailey & Cohen (2002)	7.2	11.6	21.4		97
3. Macdonald & Cohen* (2002)	6.7	10.1	20.8	75.1	64

*Expt. 3, filtered lyrics for half the excerpts

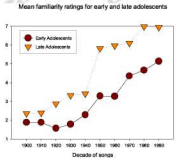
7. Results Expt 1



Older adolescents and seniors show opposite preferences for popular music, and immediate recognition reflects preference. The data are consistent with the formation of a music grammar during adolescence.

8. Results: Expt. 2

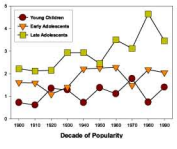
Mean Familiarity of Excerpts of Popular Music as a Function of Participant Age and Decade of Music



Familiarity functions change with age and reflect exposure in adolescence (Familiarity data not collected from children)

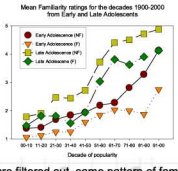
9. Results: Expt. 2

Mean Recognition (*d'*) of Just-Presented Excerpts of Popular Music as a Function of Participant Age and Decade of Music



Late adolescents have better memory overall and particularly for recent popular music; early adolescents show overall weaker memory without priority for recent styles

10. Results Expt. 3



When lyrics are filtered out, same pattern of familiarity x decade and participant age is obtained, suggesting results of previous studies are due to music and not to lyrics

11. Conclusion

- The results are consistent with the view that much musical grammar is acquired after the critical period for verbal language
- There may be an adolescent critical period for music grammar acquisition distinct from that for language occuring in pre-adolescence
- Such a period of plasticity is consistent with data on adolescent neural development in the temporal lobe and the cerebellum, both of which are significant for music

12. Significance

- Understanding the development of enduring music-preference and music-memory acquired during adolescence may lead to insights in understanding learnability during adolescence, including acquisition of addictive behaviours
- Music provides a way of probing adolescent brain mechanisms underlying the development of enduring pleasurable habits
- Further support may emerge from current work by Elizabeth McFadden which will examine middle adolescence

13. References

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15. Copy of the Poster

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