

CASE STUDIES ON ABSOLUTE PITCH

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Absolute pitch (AP) seems to be one of the most remarkable phenomena of the long-term auditory memory. AP possessors can identify or also produce musical pitches (e.g. C, C#, D, etc.) without using any external reference tone. The aim of the present investigation was to determine the prevalence of AP in students of Polish music schools. In the first part of the investigation pitch-naming test with piano tones was applied to about 1100 subjects. The test was accompanied by a questionnaire including questions about the details of musical education, familial aggregation of AP and the features of musical hearing. In the second part tests with tones of various timbre were applied to 31 students who had identified more than 50% pitch values in the first test. In the present paper discussed are individual cases of various forms of AP.

Keywords: absolute pitch, various kinds of AP, effects of speed, effect of timbre.

1. Introduction

Absolute pitch (AP) is an intriguing ability that can take various forms. In case of genuine AP possessors [1] the number of pitch standards stored in long-term memory, LTM, extends from one or a few pitch values (partial AP) to 12 pitch standards (full AP) corresponding to within-octave musical pitch classes. Some AP possessors can only recognize (passive AP) while others can also produce vocally or with a generator (active AP) the pitches of the equally-tempered musical scale, without using any external reference tone [2]. AP is a complex phenomenon, so not surprisingly results of detailed investigations indicate that almost every AP possessor seems to present an individual AP type.

2. Experimental search for AP

Absolute pitch (AP) is commonly believed to be an extremely rare ability. Basing on the superficial observations and sparse data it is estimated that among Western musicians it occurs only in about 3–5% of the population. So far, also in Poland there have not been enough data concerning the prevalence of AP, so it seemed important to undertake research to determine the percentage of Polish young musicians who possess AP.

In the first stage of the investigation more than 1100 students of Warsaw primary and secondary music schools, students of Warsaw Academy of Music, and students of the Institute of Musicology at Warsaw University were examined. A special set of pitch-naming tests with two different paces of tone presentation (every 6 s and every 2 s) was applied. The aim of the tests was to examine the accuracy of AP and determine the time needed for full identification of the musical pitch. Each of the tests comprised 25 piano tones spread over a range of five octaves. The order of tones was random except that tones having the same chroma were never presented successively.

The tests were accompanied by a questionnaire with questions about musical education, specific characteristics of various kinds of AP, features of musical hearing, and familial aggregation of AP. The questionnaire results, together with the test data, enabled to distinguish subjects with various types of AP and provided information that was helpful in explaining the genesis of AP.

The second stage of research was focused on examining whether the subjects who had recognized more than 50% of pitch values in the 6-s piano test could be influenced by the timbre of tones in their responses. Three slightly different versions of tests with pure tones, piano tones and synthesized complex tones with 2-s pace of presentation were applied to 31 students of Warsaw Academy of Music.

3. Individual cases of absolute pitch

The tests, supplemented by the results of the questionnaire, enabled to distinguish characteristic cases of various types of AP, especially within the group of Warsaw Academy students. The percentage of correct responses in both AP tests is shown in Fig. 1. The subjects are ordered on the abscissa according to decreasing percentage of correct responses. As seen in Fig. 1, the distribution of results in the first test, with 6-s pace of tone presentation, is practically continuous. The most noteworthy effect in Fig. 1 is that reduction of the time interval between the tones to 2 seconds changed the distribution of correct responses, depreciating the results of subjects whose responses in the pitch-identification task were slower and possibly based on some relative-pitch operations.

The results of the 2-s test make it possible to distinguish the group of possessors of genuine, full AP from subjects who possess only partial AP. Several subjects obtained markedly different results when the pace of presentation (time interval between the tones) was changed. One of the most characteristic cases is the listener No. 30 (Fig. 1) who reported in the questionnaire that he had partial AP based on the E chroma.

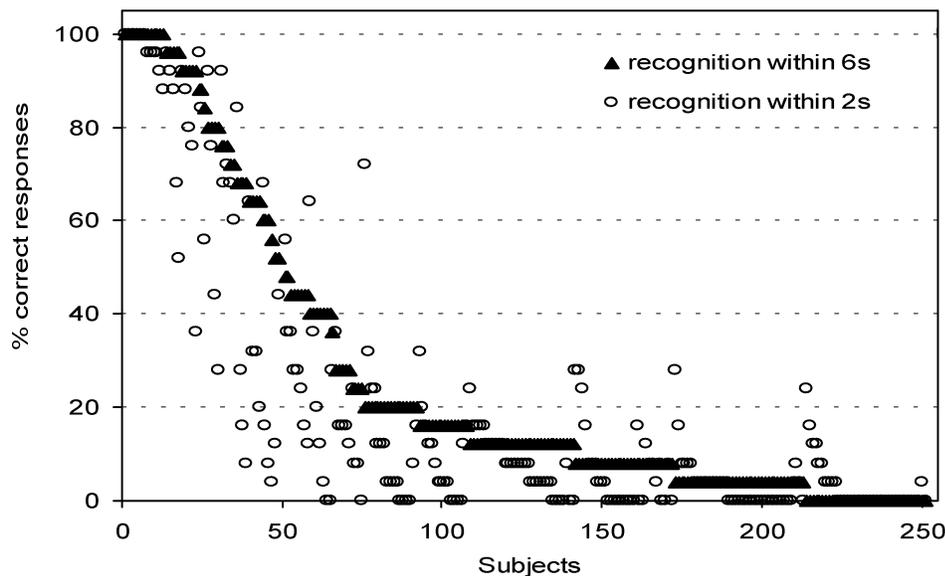


Fig. 1. Percentage of correct responses in pitch-naming tests (25 piano tones presented every 6 s and every 2 s) obtained by 241 students and 10 graduates of the Chopin Academy of Music.

By chance, the 6-s test began with E2. When the time interval between the presented tones was 6 s that subject used musical intervals as a cue for pitch recognition and gave as much as 80% of correct responses. However, the recognition of pitch values decreased dramatically (to only 28%) in the 2-s test because the subject did not have enough time to assess the pitch distances between the tones with the use of musical intervals.

A next noteworthy subject (No. 44, Fig. 1) gave 60% of correct responses in the 6-s test but when the criterion for correct answer was more liberal and enlarged by ± 100 cents his score increased to 100%. An explanation for this effect was found in the questionnaire. The subject reported that the piano he had been using in the childhood was tuned by a quarter tone higher, in comparison with the tuning standard of the equally-tempered scale. For this reason, the pitch standards stored in LTM of subject No. 44 were higher than those used in the test (according to $A4 = 440$ Hz). For this subject, the uncertainty in pitch identification, e.g., whether a given tone was C or C#, F# or G, was fully justified, so numerous semitone errors occurred when a very strict correct-answer criterion was used.

In the youngest age group (primary music school students) a 12-year-old subject, who obtained 64% correct responses in the 6-s test, and 52% in the 2-s test is worth being mentioned. In the first test, that subject recognized all white-key notes (notes with no accidental), but only three chromatic ones. In the 2-s test he identified diatonic tones fairly accurately, but named none of the chromatic pitches. This result confirms the hypothesis that AP is an ability gained gradually [3]. First stored are the diatonic standards in the LTM (what is consistent with the rule of “magical number seven” [4]), and next

the pitches corresponding to chromatic tones. Probably this listener will improve his AP in the future and will become a possessor of genuine full AP, with 12 pitch standards.

Results of the second stage of investigation (Fig. 2) show that in case of some AP possessors the timbre of tones has a significant effect on pitch recognition.

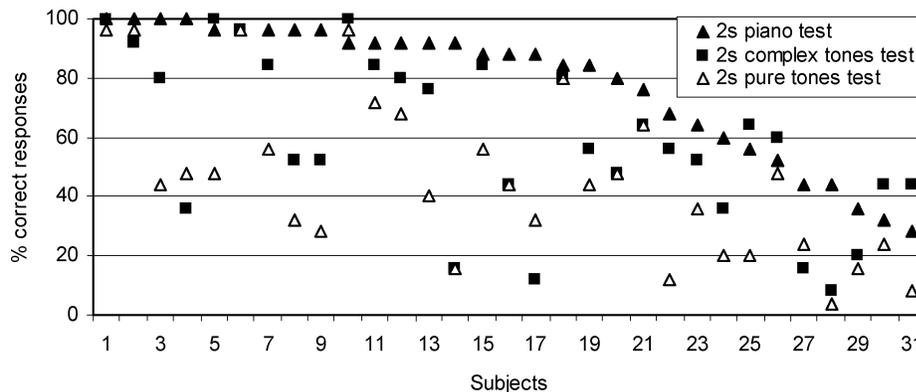


Fig. 2. Percentage of correct responses in identifying 12 chromas in three pitch-naming tests (piano tones, complex tones and pure tones presented every 2s) by 31 students of the Chopin Academy of Music.

In the most distinct example, subject No. 14 (Fig. 2), the percentage of correct responses decreased from 92% in the 2-s test with piano tones to 16% in the test with pure tones and 16% in the test with synthetic complex tones. Even the best subjects (e.g. No. 3, Fig. 2, 100% in both piano tests) had problems with recognition of the pitches of pure tones (44%). Only eight of 31 subjects obtained similar results in three tests with different timbre. The responses of the remaining subjects were to various degree dependent on the timbre of stimulus, so those subjects may be classified as having a “timbral AP” [2].

The present investigation confirmed that AP is a complex phenomenon and very often individual analysis of a particular case of AP is necessary to determine the character of AP.

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