

## Absolute pitch and Tone Identification

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**Abstract:** Absolute pitch (AP), besides the psychological and neurological interests it has, raises also some conceptual difficulties, which can teach us about the richness of our notion of musical tone and various aspects of its identification. It is argued that when AP is conceived under a slim notion of identification it is hardly meaningful, and has no significance in music comprehension. The rich notion, in spite of being vague and hazy, is the meaningful and important one. It involves knowing the position of a tone in a tone-space and its relations, and not only identifying the pitch of a crude sound. This is presented as an instance of identifying objects under concepts or in a system of concepts, as against crude identification of "bare particulars". As such, it is also claimed to be vital in passing between different sense modalities, and can explain various aspects of AP and puzzles connected with it.

Absolute pitch (henceforth AP; I shall use the abbreviation also for the possession of AP), sometimes called perfect pitch, is often characterized as the ability to immediately identify, without external aid, the pitch of a heard tone.<sup>1</sup> Sometimes this goes together with the ability to immediately identify the pitches of tones comprising a heard chord. We shall concentrate here on the former. Some researchers distinguish between an active and a passive AP. The above characterization applies then to the latter. An active AP is then the ability to immediately produce (say, in singing or whistling) the exact pitch of a note identified by name or sign.<sup>2</sup> AP is distinguished from "relative pitch", which is the ability

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<sup>1</sup> I shall use "tone" for a heard sound and "note" for a customary sign for it.

<sup>2</sup> Pitch, along volume, timbre and duration, is often presented as a property of tones.

This may be misleading in many ways, but even if one chooses to talk this way, it

to identify the pitch of a tone relative to another, given one. Relative pitch, which can be learned and cultivated, is considered a central musical ability, whose importance in music comprehension is unquestioned, while that of AP is.

The ontological categorization of tones beset serious problems, on which there is recently a rapidly growing literature. Tones are often considered a sub-category of sounds. And sounds have been argued to be objects, qualities, secondary qualities, events, event-sources, and more.<sup>3</sup> There are important issues involved here, but I shall not delve on them, as this will detract us from the main subject of this paper. I shall rather talk of identifying tones as a special instance of identifying objects, in this very general and loose sense of the term, in which it is whatever is object of identification. This wide and general sense of identification is a key notion in our perception and thinking. We identify persons, places, colours, numbers, sounds, shapes, looks, etc. Some are individuals, some universals, some particulars, some properties, some concrete and some abstract. In each of these it seems that different criteria are employed in ascribing the ability of correct identification.<sup>4</sup>

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should be noticed that pitch is an essential property of tones, or that tones supervene on their pitches, in a way that timber, volume and duration are not: change of pitch, unless very slight, is change of tone, while change of volume, even when significant, is not. I shall therefore not be strict on distinguishing identifying tones from identifying their pitch. This also accords with the way musicians usually talk of tone-identification.

<sup>3</sup> A very useful compilation on this, with a helpful introduction is *Sounds & Perception*, M. Nudds and C. O'Callaghan, Oxford, 2009.

<sup>4</sup> Readers familiar with Strawson's *Individuals* (Methuen, 1959) should notice that I am not concerned with identifying (or re-identifying) tones as particulars in his

This variety and the general use of "identification" over it raise problems over and above the problems that pertain to each of its members. I shall leave these aside here, for my aim is not strictly ontological. There is however a feature that pertains to many of these cases, which is relevant to the identification of tones and has a more general significance: The criteria we employ in identifying objects often have to do with surrounding knowledge about the object concerned. It seems though we wish (and need) to keep the distinction between the very identifying of something and knowledge about it. This may lead to minimizing the amount of knowledge we should require as a pre-requisite for identification, and in the extreme - to reach a "crude identification" of a "bare object". The theory of bare objects (or "bare particulars") has come under heavy criticism, at least since the mid last century. Objects are always given to us imbued with propositional knowledge, and their identification thus appears to be much more conceptual than the crude conception portrays. One important route for keeping the above distinction in a way that allows for understanding the relationship between its two sides is to regard identifying an object as always identifying it **under a concept**, or in a system of concepts. This, though still not propositional knowledge, is yet conceptual, and may pave a way to understanding the relationship between identifying an object and knowledge about it.<sup>5</sup>

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sense. Tones in my use are closer to his universals or "thin particulars" (see e.g. p. 70, and the whole ch. 2); and even more so to Scruton's "secondary objects"; See chapters 1 and 2 of his *The Aesthetics of Music*, Oxford, 1997.

<sup>5</sup> I personally like to think of it in the context of a Fregean theory of sense, and prefer talking there of "identifying under a sense", for, evidently "concept" is not used here in the Fregean sense. But I shall not pursue this here.

I shall not delve here into these heavy waters, but focus on one example of it, which seems to me neat and illuminating – the possession of absolute pitch and the identification of (pitched) tones involved in it. On a common conception of AP, it comes as close as any case to the crude identification of an object – the AP of a bare tone. I shall argue against this conception, and claim that the identification of tones involved in AP is a rich notion, in which a tone is identified in a system of concepts and relations. On the way to substantiating this and sharpening our intuitions regarding it, I shall briefly allude to some other cases of rich identification, and present some puzzles on AP, in the solution of which this rich conception of identification seems crucial. This, if correct, supports the general view that the notion of identifying tones, involved in AP, is a conceptually rich one; and from this we may learn more generally about other cases of identification.<sup>6</sup>

Much in the above characterization of AP is obscure and raises a host of problems. Some of them concern empirical issues, on which much research has been carried out and some important findings obtained.<sup>7</sup> We shall leave these aside and rather concentrate on

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<sup>6</sup> In recent researches it has been found that "super-recognizers", who show fantastic abilities to identify faces, do about normal when shown faces in inverted positions (R. Russell, B. Duchaine, K. Nakayama: "Super-recognizers: People with extraordinary face recognition ability", *Psychonomic Bulletin & Review*, 2009, 16 (2) 252-257). This is not strictly relevant to our case of AP, but in a remote way it may support the claim that the pertinent notions of identification are imbued with a conceptual framework. Super-recognizers identify faces given as such – as faces in their normal position – and when inverted or distorted they lose this "face-aspect".

<sup>7</sup> On some of the empirical findings and speculations see: D.J. Levitin & W.E. Rogers: "Absolute Pitch: Perception, Coding and Controversies", *Trends in Cognitive*

one of a conceptual character: What is meant by "identifying" a tone in these formulations?

There seem to be three main criteria for correct identification of tones: labeling, memory judgments and ability to reproduce. Each raises problems of its own, but with respect to all three I shall argue below that when conceived under a slim notion of the ability concerned – labeling a heard tone, or performing some memory-tasks with it, or reproducing it, detached from some basic knowledge regarding it, they are inapt for identification as involved in AP, and, in fact, unintelligible. On the other hand, all three do fine when conceived under a rich notion fused with concepts and relations pertaining to the tone identified.

Let us start with a little puzzle about the third and commonest criterion: A common criterion for AP, i.e. for identifying a tone, is the ability to immediately re-produce the pitch of a heard tone, say, on an instrument one knows how to play. However, in showing this ability there is a great difference between the means of reproduction. Most people can easily repeat a heard tone, or even a short melodic phrase, by **singing** or whistling in the correct pitch. This ability is very common and is not considered evidence for AP. However, many of them will be unable to do it on an **instrument** they know how to play. An ability to do this (even when they don't know the names of the notes they are playing) is considered evidence for AP. Why? What is the root of the difference? If ability to repeat a heard tone or phrase on the flute (or violin) is a sign of its identification (and evidence for AP), why is the ability to repeat it by singing not regarded as manifesting

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*Science*, vol, 9 no. 1, January 2005. On some aspects of the relationship between AP and memory see also: Judy Plantinga and Laurel J. Trainor, "Infants' Memory for Isolated Tones and the Effects of Interference", *Music Perception*, Vol. 26, No. 2 (December 2008) (pp. 121-127).

such identification? It seems to me that any serious account of AP and of the identification involved in it must address this problem (and related ones, some of which will be mentioned below), which we shall call "the singing/playing discrepancy" (SPD).<sup>8</sup>

It should be noted that we don't seem to have a similar discrepancy with regard to speaking and writing: It seems that a proficient writer or typist can write or type a heard word or phrase, even when perceived "phonetically" without understanding it, with more or less the same ease in which she can repeat it in speaking. We can also easily repeat a heard rhythm (with our mouth or hands or an instrument). The discrepancy, however, is vast with respect to the ability to repeat (in the correct pitch) a heard tone or short melody in singing as against in playing. Why? This is not meant to be a question about the biological mechanisms involved in the two cases, but about the significance of our regarding the one as satisfying a criterion for AP and the other as not. To this problem we can add a small addendum: In reading music notes the relation seems to be the opposite: an experienced player can play seen notes on an instrument quite easily, directly and "naturally", while singing them requires a special skill (*solfeggio*) and singing them in the correct pitch requires AP. Why is that so?

It seems that the answer surely has to do with our experience (perhaps in early childhood) and with our learning to speak, which surely involves imitations of various

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<sup>8</sup> I hope SPD doesn't sound like asking why is skiing harder than walking. But there is no analogy. SPD is about the easiness of repeating a heard tone in singing in comparison to repeating it on, say, the violin even by a proficient player. The difficulty it asks about is somewhat analogous to one we would have faced if a proficient typist would find it much harder to repeat a heard word in typing than in speaking ("somewhat" because there are differences that even make SPD more acute).

sorts. But this is too general. It should be noticed that we usually have very little experience in imitating or reproducing pitch. Neither are we normally required or encouraged to do so. Further, even assuming that sometimes we do imitate pitch, this must involve identifying what is imitated. Why then isn't that considered evidence for AP? So if experience can account for SPD it must be in a very complicated and roundabout way. We still need to be more specific of what is involved.

In order to sharpen and emphasize the conceptual nature of the problem, we should notice that basic relations, like being higher/lower than-, which may naturally be regarded as part of the rich notion of tone-identification, are not required in the imitation involved in singing: we should not expect someone imitating adjacent heard tones by singing them to know which are higher/lower, while such knowledge is naturally expected of tone-identification as manifested, e.g. in AP. Evidently, such knowledge may accompany the singing ability (to imitate). But is not part of it. It is, however, constitutive of tone identification, or so at least we shall argue.

Roughly, the answer we shall propose is rooted in the notion of identification alluded to above, which, as exemplified in AP, we shall argue, is a conceptually rich one. Repeating a tone or phrase by singing (or whistling) seems to us natural and direct in a way that does not require the mediation of such rich identification of the tones concerned. Doing it on an instrument, on the other hand, does require such identifying mediation. What the nature and role of such mediatory identification is, and what "natural" means here are not easy questions, to some aspects of which we shall return later. If correct even in its general outline, this answer supports the view that identifying tones, as exercised in manifestations of AP, is conceptually rich – it is identifying them under concepts.

In its regular use identifying a tone does not mean only being able to repeat it or to attach a name or a label to it – these are not only not necessary, but also not sufficient:

identifying a tone involves also knowing its position and role in a certain system or space of tones, their properties and relations, e.g. some intervals, scales, basic chords and harmonic functions. This, as we shall see below, is true of many other cases of identification – even those involved in manifesting AP: when e.g. pianists are concerned, it applies also to knowing special places and spatial relations on the keyboard, or, for violinists – on strings (with their tonal significance). Such knowledge may be regarded as part of what "identifying" a note-key on the piano, or a position on the string means.

In order to clarify this let us think of the following example: Imagine someone who, when seeing a box of matches spread on the table and asked how many they are, says immediately 57; and with another box – 65. Suppose both are correct and that this is also the case in many other instances. However, when asked which box contains more matches, or which of the numbers is bigger, our savant hasn't got an idea of what he is asked for, or gives correct and wrong answers at random. Would we say he identified the numbers of matches? I think we would not – knowing that the first box contained less matches than the second seems a necessary condition for ascribing him such identification; or, at least we should distinguish between a **slim and a rich notion of identification**, where in its regular use identification is fairly rich. I leave "fairly rich" in its vagueness, for it seems impossible to tell in advance which of the infinitely many mathematical relations between these two numbers he should know. This is something we would usually determine according to specific aims and other pragmatic factors of the situation. But for our regular notion of identifying numbers he should evidently know some, like that 65 is bigger than 57, that it is the following natural of 64 etc.

Likewise we should distinguish between a slim and a rich notion of identification in many other cases, including that involved in AP. In spite of the fact that we can think of criteria for a crude identification of the pitch of a sound as an acoustic phenomenon,



when such identification is slim and detached from knowing the relevant space of relations, it is very doubtful whether we would regard it as identifying a tone in the "fairly rich" sense required. On the other hand, it is evident that knowing this space, with its properties and relations, is not sufficient for the identification concerned. One may have a very good relative hearing without having AP at all. It is nevertheless important to bear in mind that these conditions, not being sufficient, are still relevant and perhaps necessary for the identification concerned. It should be noted that rich identification, involving as it does knowledge of various concepts and relations, is still identification of a particular (a tone, a number etc.). It is rich in that what is identified is not a "bare sound", but is conceived under these concepts and relations. This is what slim identification lacks.<sup>9</sup>

These considerations about the nature of the identification concerned are connected with a central problem in the philosophy of music and its ontology, namely, what is the nature of (musical) tones. We shall not discuss it here, but point out that a musical tone (to be distinguished from sound or noise) is **conceptually rich**: it is not a crude acoustic event, but an acoustic event under a particular description (tonic, leading tone, etc.), which expresses the concepts in which the tone is conceived, and which relegates it to a tonal space in which it is conceived. By this I mean that the concepts and relations concerned (which may vary from one musical culture to another) do not form a "super-structure" imposed on a given array of tones, but are rather constitutive of the tones and

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<sup>9</sup> I shall not delve on the question of whether the talk of absolute pitch is meaningful at all. It certainly may irritate holistic and relativistic ears. I assume it is clear enough for our purposes (for which the fact that it changed in the last 150 years is also indecisive).

their identity. Some philosophers might express this by saying it is an intensional entity.<sup>10</sup> The claim made here about the conceptual richness of the identification of tones squares with this intensional conception of tones.

Many ascribe AP much significance in musical activity, music comprehension and education. Many musicians possess it, and the rate of people with AP among musicians is much higher than their rate in the general population (which is about 1:10,000). It is quite certain that up to a certain (good) degree, AP is an acquirable ability, and the likelihood of acquiring it, with moderate training, up to the age of about nine is very good and very much higher than later. Many of the great composers had AP and many of the professional performers and musicians have it.<sup>11</sup> From all this it seems that there is a strong connection between AP and musical talent. Currently there are courses and books devoted to teaching and bringing music students to acquire AP. On the other hand, besides the fact that many excellent musicians don't possess AP, it is claimed that the rate of people having AP among speakers of "tone-languages" (Mandarin Chinese and some others), in which the pitch of a spoken word or phoneme is semantically significant, is

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<sup>10</sup> See G. Bar-Elli: "A Note on the Substitutivity of Notes", *Analysis*, vol. 41, 1981, pp.27-32; R. Scruton: *The Aesthetics of Music*, Oxford, 1982, chs. 1-2.

<sup>11</sup> The data here is inconclusive. Recently there seems to be a "vogue" of discovering great musicians who lacked AP. For example, in an internet article E. Gold, admitting himself to lack it, remains indecisive about Bach and Handel, but relates (on personal acquaintance) that Bernstein and Stravinsky lacked it, and says that Schumann Wagner and Horowitz very probably lacked it, and that it is doubtful whether Haydn, Brahms, Ravel and Mahler possessed it.

especially high.<sup>12</sup> This has nothing to do with musicality, but the linguistic phenomenon, not less than the musical one is a case of rich identification, in which the identified particulars are conceived in a system of concepts and relations.

My central claim in this connection is that **AP, when conceived with a slim notion of identification of a crude tone, detached from the tone-space and its relations, if meaningful at all, is insignificant for music comprehension** and may even be a hindrance to it.<sup>13</sup> In order to see this and the significance of "in itself" in the above formulation, let us sharpen and enhance the above consideration about identification. Consider someone having AP but being "interval deaf": Upon hearing C-E and G-B she is unable to **hear** and to experience it as the same interval. She might say it is the same interval and respond appropriately to various tasks, but she will not **hear** it: she will **figure it out** or derive it on the basis of identifying the four tones (and knowing some elementary theory) and then figuring out that these must have been two instances of a major third, but she will not **hear** it. Her responses to it will differ (perhaps being slower) from her responses to things she hears.<sup>14</sup> But evidently, such hearing and experiencing is

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<sup>12</sup> Though some experiments may cast doubt on that. See "Is There an Asian Advantage for Pitch Memory?", *Music Perception*, Vol. 25, No. 3 (February 2008), pp. 241-252.

<sup>13</sup> As is well known AP can be a hindrance in transpositions or when performing on an out of tune instrument, but this is not my point here.

<sup>14</sup> This is not entirely speculative. For some related experimental data see Ken'ichi Miyazaki, "Absolute Pitch as an Inability: Identification of Musical Intervals in a Tonal Context", *Music Perception*, Vol. 11, No. 1 (Fall, 1993) (pp. 55-71), where it is argued that some listeners possessing AP are relatively poor in identifying pitch relations in tonal contexts and sometimes tend to stick to absolute pitch even in a task

what is important for music comprehension and understanding – to hear and to experience the identity of the interval, not to calculate it or derive it from other things one hears.

This might be likened to someone having an absolute sense of length or height: On seeing an object (person, tree, house etc) he can immediately say its height. We can imagine however that such a savant will not see height or length relations. He will not be able to see that A is higher or longer than B. He will see A, and B, know immediately their heights, and then derive or figure out that the one is higher than the other, by knowing that A is say 1.87 and B is 1.76 and knowing that the first number is bigger than the second. I think we would all agree that something is defective in his sight – he doesn't see what we do – though he can respond correctly and behave generally like us. We can likewise imagine something similar with respect to colours: Most of us seem to have an "absolute sight" of some colours. Imagine someone who identifies colours well but cannot see e.g. that yellow is brighter than blue. He can figure it out by identifying the colours and knowing some theory about colours, but cannot see it. I think we should say that his visual perception is different from ours and doubt, e.g. whether he sees a Kandinsky's picture as we do.<sup>15</sup>

Likewise, our interval deaf can hardly be said to hear music, definitely not like us. In fact she will also not hear, upon our playing her twice C-E, that this is the same interval. She won't even understand our question whether she hears the same interval. Again, she

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that needs relative pitch, resulting in poor performance in perceiving musical pitch relations.

<sup>15</sup> See Part I of Wittgenstein's *Remarks on Colour*, University of California Press, 1978, where various deviations and failures in grasping the "logic" of colour words (though not this one) are considered.

may figure it out by identifying the four notes separately, but not hear the intervals. She can hardly, therefore, be said to have our notion of an interval. More than that, we can imagine her not being able to identify a tone: she may not hear the tonal identity of two tokens of the same tone. Upon hearing middle C twice, she will not hear it as the same tone, but derive it or figure it out by identifying each as middle C.

This difference between experiencing (e.g. tone-intervals, colour relations, height relations, etc.) and calculating them is an instance of the above distinction between identifying-under-concepts and knowing about. Tones are conceived and identified under concepts and relations as involved in hearing e.g. intervals. They are not crudely identified as "bare objects", which is then somehow attached to knowledge about them. And what we have said about intervals is true of actually most musical concepts: We can imagine someone with AP who is unable to hear tonality, though he may figure it out or derive it (on the basis of some theoretical knowledge) from identifying the tones; He would not hear harmonic relations (like the one between tonic and dominant), would not hear the difference between a consonance and a dissonance and various kinds of musical tension, would not hear modulations, cadences, sequences, transpositions, etc.<sup>16</sup> All these he may figure out or calculate by identifying tones, but not hear them, not experience them.<sup>17</sup> But, to repeat, such hearing and experiencing is what hearing music is all about.

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<sup>16</sup> These, though presented here as thought-experiments, are not entirely hypothetical.

In the above paper Levitin and Rogers cite researches according to which persons with AP did very poorly, in comparison to others, in recognizing sequences and transpositions of simple phrases. See also Myazaki's paper cited above.

<sup>17</sup> In various reports of savants (e.g. Daniel Tammet) and about them the situation is almost the opposite: various exceptional mathematical and cognitive abilities are described by them as sense perceptions.

One who is deprived of this does not hear music in the normal sense and does not experience it, though he may know, by way of figuring out and deriving, much of what we know.

Having said all that, we must re-emphasize that when AP involves rich identification, this is not confined to perceiving relations like the above, but is **identifying the tones themselves** under some concepts and relations. So, with such AP one does not only hear e.g. a major third, but identifies the tones comprising it. I cannot indulge here into a discussion of what identifying something under a concept is, but will just express my view that it need not be identifying a "bare it" plus applying the concept to it. I therefore don't think that the rich concept is necessarily built on the slim one.

We have brought these various thought-experiments of "deafness" in order to sharpen and emphasize important factors of our musical hearing, of which the deaf concerned is deprived. AP, in the slim sense of identifying a crude tone, is compatible with these kinds of "deafness". In fact, in this slim sense it is not very different from the ability to **identify notes on paper**. And here, as there, we can imagine such an ability to be detached from *solfeggio* ability – from any ability to fancy or know how the notes concerned would sound. Such crude identifying ability is possessed at a certain stage, by any kid beginning to read notes: He sees a note – a sign on a stave – and says C; He sees another note and says E etc. We can imagine him at this stage to know nothing about how they would sound, how would the interval between them sound, which one would sound higher, etc. Such a kid (supposing him to be especially bright and knowledgeable) may figure out these things: he may figure out which tone is higher, how is the interval between them called, when such intervals are equal etc. But by our supposition he will not experience these, he will not have an "inner hearing" of them and will not know how

they should sound.<sup>18</sup> In principle, AP, in the slim, crude sense of identification, is no different from such identification of notes, except that instead of the eyes one uses the ears.

Let me emphasize again that these things are not meant to be true of persons with AP and of their musical experiences – by no means. **Their aim is rather conceptual:** to reduce the slim, crude sense of identification (and a notion of AP based on this) to the point of absurdity, in which it looks hardly intelligible, in order to sharpen and bring to the fore essential elements of our notion of a musical tone and of musical hearing and music comprehension. Chief among them are the following: 1) The recognition that a musical tone and its identification are rich concepts involving experiential knowledge of its position and status in a tone-space with its properties and relations, 2) The recognition that hearing and comprehending music consist of hearing and experiencing (as against figuring out, calculating and deriving) the musical concepts and relations concerned. AP, under the rich notion of identification can accompany and even enhance this, but is not necessary for it. Under a slim notion of identification, if intelligible at all, AP is neither necessary nor sufficient for it, and hardly relevant.

These considerations support the general philosophical view that it is a mistake to conceive of perceptual identification as crude identification of a particular plus derived knowledge about it: it is rather identification of the particular under or in a system of concepts experienced by the identifier.

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<sup>18</sup> For a philosophical background and elaboration of this difference between experiencing and figuring out, with reference to Wittgenstein's late writings, see G. Bar-Elli: "Wittgenstein on the Experience of Meaning and the Meaning of Music", *Philosophical Investigations*, vol. 29/3, July 2006, 217-249.

On the basis of the above considerations we may come back to the SPD problem posed above: Why singing (or whistling) a heard tone is easy and not considered to manifest AP, while repeating it on an instrument – is. We suggested, in brief, that the latter involves and depends on identifying the tone, which the former does not, and that the identification involved is a rich one. One may still protest that the former also involves identification – exactly that which is expressed by repeating the tone in singing. One may go even further and ask what does identification have to do with the difficulty at question? In response let us emphasize again that the gist of our considerations is that our regular notions of a musical tone and of identifying tones are rich concepts that involve perceiving tones in a system of properties and relations, including even a sort of a metrics over the tones. The difficulty in repeating a tone (or phrase) in another system in another medium – e.g. the spatial dimensions of the piano keyboard – is therefore a difficulty in mapping this system into the new medium. This is why the rich notion of identification is required here and this is why passing between them may be difficult. In singing, on the other hand, the relevant system is so close to the one involved in hearing, and the congruence between them is so readily accessible, that we hardly feel a difficulty in passing from one to the other, and identification in the rich sense is therefore not required.

Perceptual or sense modality is also crucial here, and especially the difference between hearing and seeing. When the two systems (the origin and the target) are both seen, the congruence between them may be readily accessible. And then passing between the two, though it may require some learning, is relatively easy. This can explain why, for a trained pianist, playing on the piano from a score – "repeating" on the piano what is seen in the score – is (relatively) easy, in comparison with playing what is heard, and does not require AP. The score and the piano keyboard are both spatial seen systems, and



the congruence between them is easily mastered. Passing between them does not require AP. A kid beginning to learn to play the piano learns to map the visual notational system to the visual spatial system of the keyboard. Although this evidently involves some sort of identification (he may even know the names of the notes) it has nothing to do with AP and with the identification involved in it. Hearing (a tone or a melody) on the other hand is a different perceptual modality, and heard tones form a system whose congruence with the spatial one of the keyboard is much harder to grasp and less accessible. Passing from one to the other may therefore require AP. Likewise this can explain why singing from a score (in pitch) is difficult and may require AP. For, whatever the sense modality of sung tones is, it is probably very different from the spatial seen notational system. By the same token, repeating in singing a heard tone or phrase need not require AP, for it involves mapping closely congruent systems in the same, or in very close perceptual modalities.<sup>19</sup>

The SPD and related problems and the distinction between the slim and the rich notions of identification of tones alluded to above are apparently different issues, each calling for explanation in any serious treatment of AP. They both stand on their own merits independently of our speculation about the sense-modalities and their relative congruence, and even if this speculation is rejected. This speculation, however, connects them in suggesting that the latter is a clue to the former.

We may conclude our discussion by saying that the tone- identification involved in AP has two characteristic facets: 1) It is not crude identification of the pitch of a tone as

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<sup>19</sup> I don't know how to define this, and must leave it to the mercy of intuitive understanding. I assume that the sense modality involved in singing is much closer to the auditory than to the visual one, in somewhat like the way in which the tactual sense is closer to the visual than to other modalities.

an acoustic phenomenon, but a rich concept, in which a tone is perceived in a tone-space with its properties and relations. 2) It is manifested in the ability to pass between different sense modalities, in particular, seeing and hearing: in the ability to map, in an easily accessible way, the heard tone-system to the visual spatial one, whereas identification in the same sense modality, or in close ones, may not be evidence of AP. But let it be noticed again that be the case with SPD and its explanation what it may, the main point about AP involving a rich notion of identification remains. The hypothesis about SPD gives it support, but it is not dependent on this hypothesis.

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