Chapter 10
Through a Glass, Vividly: Shedding Light on the Extraordinary Musical Journeys of Some Children on the Autism Spectrum

Adam Ockelford

Introduction

On hearing the sound of the organ, the baby stayed quite still in his mother's arms. Just twelve months old, he had been born totally blind, and it later emerged that he was autistic and had severe learning difficulties as well. His mother had brought him to meet me at the special school where I was then head of music.

When they arrived, a pupil was playing the organ. On hearing the sound, the baby was transfixed. He listened, intently, for around quarter of an hour, while the organ music continued. I remember thinking (and mentioning to his mother) that here was a child who evidently showed signs of exceptional musical *interest*, which may or may not translate into exceptional musical *ability* as he grew up. At any event, it seemed important to ensure that he was exposed to a wide range of a different musics in the coming months and years, had access to instruments and other sound-makers to explore freely and to play with, and had plenty of close, enjoyable musical interactions with his adult carers involving the voice, movement and touch.

I next met the little boy six months later. This time, his mother lifted him up onto the piano stool, and he proceeded to pick out a series of nursery rhymes that were, I noticed, in C major. This suggested to me that he had encoded the melodies using 'relative' rather than 'absolute' pitch ('AP'); that is, through patterns of intervals rather than the notes themselves, since there would be no particular reason why the tunes he had learnt to play should all have appeared in one key.

A further six months passed, and we met again. As the two-year-old sat on his mother's knee at the piano, I hummed *Twinkle, Twinkle* in A major. What would he do, reproduce the notes themselves (suggesting that he may have AP) or, as before, replicate only the differences between them (indicating that 'relative' pitch was still his predominant processing strategy)? The answer came straight away. Not only did he reproduce the tune in the correct key, but it also appeared with a rudimentary accompaniment, comprising individual notes, in the left hand.

I was astonished. Here was someone who, despite never having seen anyone play, with little or no understanding of language, and with minimal adult intervention, had

> taught himself to play the piano – an accomplishment that few adults ever achieve, let alone 24-month-old children with severe learning difficulties.

During the last three decades of engaging through music with autistic children, as both a teacher and researcher, I have been privileged to observe a number of simply extraordinary musical journeys – none more so than that of the little blind, autistic boy described above. I met him at a relatively early stage in my career, and was intrigued to know how he had managed the seemingly impossible task, for one so young, and with profound intellectual and sensory disadvantages, of learning to play the piano by ear. What were the factors that made it possible? Were there lessons to be learnt for other children on the autism spectrum? Indeed, were there things that all of us could take from the boy's example?

Theories of Autism

First, let us consider what is meant by 'autism'. There is general agreement that it is a lifelong, neurological condition that manifests itself early on; typically within the first two or three years of childhood (see, for example, Hobson, 1993; Happé, 1995; Frith, 2003; Wing, 2003; Boucher, 2009). Its effects can be profound, pervading the whole of a child's development. Yet autism is elusive. It is not *one* condition with a single physiological source: researchers have not been able to isolate a particular part of the brain that is wired up anomalously and say 'this is the cause'. Rather, autism is identified on the basis of observed behaviours, which can vary widely both between and within individuals in different contexts and at varying stages of their maturation. Diagnostically, the best that clinicians can currently do is to refer to a list of attributes, and say that if a child exhibits certain combinations of these, then he or she can be described as having an 'autism spectrum disorder'. Hence, as our understanding of brain function improves, it may be that the notion of 'autism' will be resolved into a number of more specific conditions.

Intuitively, this feels right: visit any centre for children on the autism spectrum, and you are likely to be struck by the diversity of those present. For instance, one child (typically a boy) may address you animatedly, as though in mid-conversation, about a topic that bears no apparent relation to the immediate environment. Another may completely ignore you, his attention apparently taken up with the parallel light and dark stripes made by the window blind, in front of which he is flicking his fingers. One of his classmates may be sitting at a desk, concentrating intently on drawing tiny geometric shapes that interlock in intricate patterns. And there may be a fourth child, standing in the corner of the room, hands over his ears, eyes closed, rocking, and producing high-pitched, repetitive vocal sounds.

All these children are likely to be categorised as 'autistic' according to the criteria published by the World Health Organisation (WHO)[1] and the American Psychiatric Association (APA),[2] which are internationally accepted and the most widely used. They define autism in terms of three broad characteristics: (a) qualitative impairment in social interaction, (b) qualitative impairment in communication, and (c) restricted, repetitive and stereotyped patterns of behaviour, interests and activities. These descriptions are broken down further as follows:

1 See www.who.int/classifications/icd/en/

2 See http://www.psych.org/practice/dsm

a. Impairment in social interaction …
   - lack of eye contact, facial expressions, postures or gestures
   - failure to develop peer relationships appropriate to developmental level
   - lack of spontaneous seeking to share enjoyment, interests, or achievements with other people
   - lack of social or emotional reciprocity

b. Impairment in communication …
   - delay in or lack of spoken language
   - in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation
   - stereotyped and repetitive use of language or idiosyncratic language
   - lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

c. Restricted, repetitive and stereotyped patterns of behaviour, interests and activities …
   - encompassing preoccupation with one or more stereotyped patterns of interest that is abnormal either in intensity or focus
   - stereotyped and repetitive motor mannerisms
   - persistent preoccupation with parts of object

Towards the end of the twentieth century, three theories dominated academic thinking about the causes of autism, each associated with one of the main characteristics of the WHO/APA definition. Defective 'theory of mind' (Frith, 2001; Baron-Cohen, 1995, 2000, 2009; Baron-Cohen, Leslie and Frith, 1985); Tager-Flusberg, 2001) – the ability to attribute mental states to oneself and others, and to understand that others may have ideas that differ from one's own – was held to be responsible for 'impairment in social interaction'. 'Weak central coherence' (Frith and Happé, 1994; Happé, 1996; Happé and Booth, 2008) – the tendency to think about things in terms of their parts rather than as a whole – was linked to communication difficulties (as well, more positively, as accounting for enhanced perception of detail and some 'savant-like' abilities). 'Executive dysfunction' (Turner, 1997; Hill, 2004; South, Ozonoff and McMahon, 2007) – a problem with the domain of processing that regulates and controls other cognitive functions – was thought to lead to rigid and repetitive behaviours.

While these accounts make perfect sense, they do not appear to be able to account for all the characteristics of and behaviours exhibited by children on the autism spectrum, particularly those pertaining to sound and music. Consider, for example, the following questions, posed to me by parents over the years.

> *Why* is Jack obsessed with the sound of the microwave? He can't bear to leave the kitchen till it's stopped. And just lately, he's become very interested in the tumble-drier too …

> *Why* does my four-year old daughter just repeat what I say? For a long time, she didn't speak at all, but now, the educational psychologist tells me, she's 'echolalic'. I say, 'Hello, Anna', and she says 'Hello, Anna' back. I ask 'Do you want to play with your toys' and she just replies 'Play with your toys', though I don't think she really knows what I mean.

> *Why* does Ben want to listen to the jingles that he downloads from the internet all the time? And I mean, the whole time – 16 hours a day if we let him. He doesn't even play them all

> the way through: sometimes just the first couple of seconds of a clip, over and over again. He must have heard them thousands of times. But he never seems to get bored.
>
> *Why* does Callum put his hands over his ears and start rocking and humming to himself when my mobile goes off, but totally ignores the ringtone on my husband's phone, which is much louder?
>
> *Why* does Freddie flick any glasses, bowls, pots or pans that are within reach? The other day, he emptied out the dresser – and even brought in half a dozen flowerpots from the garden – and lined everything up on the floor. I couldn't see a pattern in what he'd done, but if I moved anything when he was wasn't looking, he'd notice straight away, and move it back again.
>
> *Why* does Romy sometimes only *pretend* to play the notes on her keyboard – touching the keys with her fingers but not actually pressing them down?
>
> *Why* does Bharat repeatedly bang away at particular notes on his piano (mainly 'B' and 'F sharp', high up in the right hand), sometimes persisting until the string or the hammer breaks?

The main theories of autism seemed awkwardly mute on these topics. So what was the element missing from our understanding?

Blind Children, Sound and Music

As the account at the beginning of this chapter suggests, my route to working with children with autism was somewhat unusual, in that it came through the world of the blind: my first pupils with special needs were severely visually impaired. It quickly became evident that sound provided them with a hugely important channel for gathering information and communicating with others, for learning and for recreation, and I soon learnt to follow my pupils' auditory instincts, not only in music, but in their wider education too.

This aural approach, I discovered later, did not align with most of the pedagogical strategies that had evolved in relation to children with autism, which were predominantly visual in nature: augmentative communication systems such as PECS (see Bondy & Frost, 2011), and timetables and enabling environments such as those advocated by the TEACCH programme (Mesibov, Shea & Schopler, 2005) were largely constructed to be seen but not heard. And visiting schools for autistic children one is frequently struck by how much attention is paid to pupils' visual surroundings, while relatively little emphasis is often placed on what they hear, and the potential impact that sound, both planned and unplanned, may have, positively or negatively, on their well-being and capacity to learn.

Hand in hand with my developing interest in special abilities and needs was the wider issue of how music makes sense to us *all*: how is it, simply by listening, and without the need for any formal education, that just about everyone can understand and enjoy music? To this end, I developed my 'zygonic' theory of musical understanding, which holds that music functions like a non-semantic language, comprising notes rather than words, whose syntactical 'glue' is imitation (Ockelford, 2005a, 2009, 2012b). Hence we would expect repetition (of pitches, intervals, harmonies, tonal centres, durations, inter-onset intervals, metrical frameworks, rhythms, timbres and loudnesses) to pervade musical textures – which indeed it does (Ockelford, 2005b). And one would also anticipate that an intuitive grasp of the music-syntactical significance of imitation would be identifiable in children's musical development – which it does appear to be, as the findings of the *Sounds of Intent* project show (Ockelford, Welch, Jewell-Gore, Cheng, Vogiatzoglou & Himonides, 2011; Vogiatzoglou, Ockelford, Welch & Himonides, 2011; Welch, Ockelford, Carter, Zimmermann & Himonides, 2009).

An increasing amount of research (for example, Ockelford, Pring, Welch and Treffert, 2006; Ockelford and Matawa, 2009), suggests that a high proportion of blind children, around 40%, develop an advanced grasp of how musical structure works early on, usually in the first two to three years of life, and I contend that a key factor in their precocious musicality is AP. This doesn't necessarily mean that the children have learnt the names of the notes (C, D, E flat, F sharp, and so on), but that each is heard to have a distinct character.

Hence for four in 10 blind children, we can surmise that music – in fact, all sound – has an added aesthetic dimension, offering an experience that is neither better nor worse than for non-AP possessors (99.99% of the Western population), but *different*. The possession of AP can impact on proactive musical engagement too. As we shall see, playing by ear – that is, playing just by listening, without needing to read music, or being told or shown which notes to press (in the case of a keyboard) – becomes a relatively straightforward matter, since rather than trying to work out how the *relationships* between notes translate into different distances between the keys, children with AP know, even before they have pushed a note down, what it is going to sound like. So learning to play an instrument is relatively straightforward: it is just a question of finding out which key is associated with each of the pitches they can hear in their heads. And a surprisingly large number of blind children do indeed develop performing skills in their early years.

A New Theory: The Impact of 'Exceptional Early Cognitive Environments'

Why do so many of the congenitally blind process sound in such a different way from most people? Elsewhere (Ockelford, 2013), I assert that blindness causes what I call an 'Exceptional Early Cognitive Environment' (an 'EECE'), in which musical skills are particularly likely to flourish. Human brains evolved to work with a wide range of perceptual input: sight, hearing, touch, taste, smell, balance, and so on. Deny the brain its principal source of information about the world (vision), and its focus of attention will be driven elsewhere – particularly to sound – and, in the first years of life, it will literally wire itself up differently to ensure optimum performance with the limited data that it has available.

For some years now, there has been a debate among academics and educators about the relationship between blindness and autism. Clearly, there are some people who are autistic but not blind, there are others who are blind who do not have autism spectrum disorder, and there are a number who are both blind and autistic (Dale & Salt, 2008; Hobson & Lee, 2010; Pring, 2005). But the issue is that blind children are quite likely to exhibit behaviours that are generally considered to be characteristic of autism, potentially calling into question how autism is defined and recognised, and making the assessment of severely visually impaired children in the early years particularly challenging. Suffice it to say that most of the examples given above of autistic-like behaviours, such as a fascination with the sounds of certain household appliances, computers and phones, an obsessive

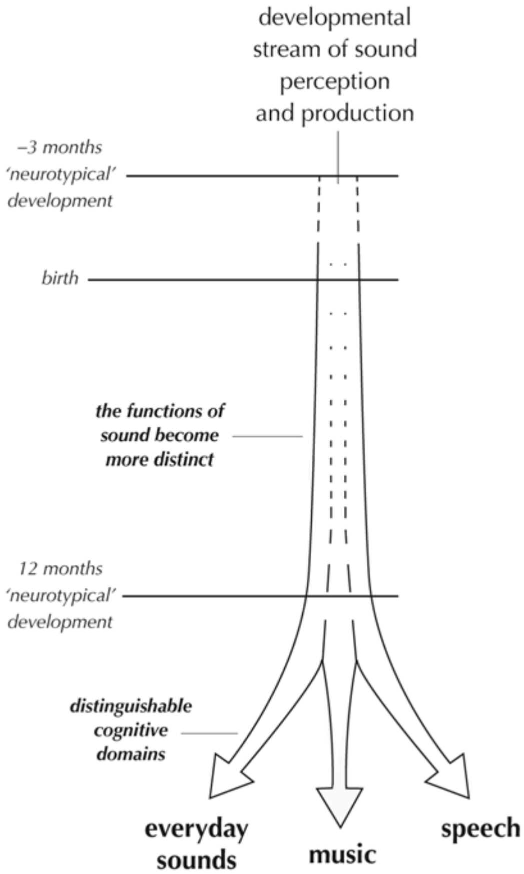

Fig. 10.1 Three-strand model of the functional processing of sound in early development

interest in particular fragments or features of music, and the tendency to echolalia, are commonplace among blind children. And, like children born with little or no sight, autistic children too have a markedly higher probability of having AP than those with neurotypical development – perhaps around one in 20 – and music is often among their special areas of interest and achievement.

So, could it be that young children with autism are also affected by an Exceptional Early Cognitive Environment, similar to that experienced by blind children, and with the same potential to promote high levels of musical interest and development? Although at the first blush this may seem unlikely (since blindness and autism are manifestly so very different), that is exactly what I believe. That is *not* to say that I believe a significant number of severely autistic children are likely to become publicly-recognised musicians, performing or composing at a high level within their culture (although some may). However, I do contend that where exceptional musical interests or abilities are to be found (and I believe

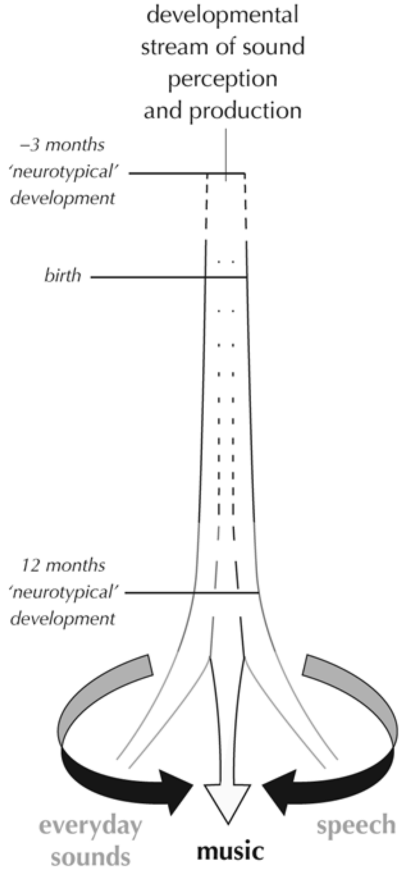

Fig. 10.2 Everyday sounds and speech may be processed in musical terms by some children on the autism spectrum

that these are far more widespread than is generally recognised among the population of autistic children, hidden in behaviours such as those described above), they should be nurtured, potentially offering both a source of enormous pleasure and fulfilment in its own right, as well as having the capacity to promote wider learning and development, and well-being.

At the heart of the EECE theory is an 'ecological' model of auditory development (cf. Gaver, 1993; Miller & Ockelford, 2005). This acknowledges that there are three distinct ways in which humans hear sounds, according to whether they pertain to speech, music or the environment (see Figure 10.1).

These three strands of auditory processing *emerge* as audition develops in the first year or so of life. But for some children who are blind or on the autism spectrum, it appears that either everyday sounds, or language, or both become processed, to a greater or lesser extent, *as music* (Figure 10.2).

Evidence that children may attach particular importance to everyday sounds (and that, in some cases, auditory perceptual skills may become heightened in this domain) comes from my studies of young people who are born blind or who lose their sight in the first few months of life. Parents report that almost all this group have a special interest in everyday sounds (around two or three times as many as those who are fully sighted). It seems that, in the absence of vision, sound has a distinctive appeal and offers a ready source of stimulation. For example, one mother commented that her blind three-year-old daughter was interested in sounds of 'anything and everything since this is a huge part of her learning experience'. Other visually impaired children appear to be attracted to sounds for the sheer pleasure they bring. For instance, the mother of a five-year-old boy noted that 'he loves repetitive sounds – [he] will press toys which make noises over and over to hear the sounds'. Other favourite sources of sound that parents mentioned included wind-chimes and birdsong, and one five-year-old boy was said to love listening to the rain and the sea: 'he loves the sound of breaking waves'. The importance of sound may become evident not only through particularly attentive or sustained listening but also through mimicry. For instance, the 18-month-old who was reported to enjoy exploring toys through the sounds they make 'also mimics a lot of sounds – not just words – like clearing your throat', while another boy of the same age was said to copy unusual animal sounds. Similarly, one mother of a three-year-old boy described his liking of the sounds that 'different surfaces make when tapped or banged' and his enjoyment when 'imitating vocal sounds we make'.

Some children with autism display a similar fascination for everyday sounds: recall Jack (p. XXX), who is obsessed with the sound of the microwave (and, increasingly, the tumble-drier), and, of course, Freddie's flowerpots. When I first met Freddie (aged nine), he indulged in a range of pursuits that bemused his parents, including habitually flicking any resonant objects that were within reach, and, one day, removing the 20 flowerpots or so (and their contents) from the patio and bringing them into the kitchen. Freddie arranged these on all available surfaces, like some earthenware gamelan, and he ran around gleefully, playing his newly-constructed instrument with characteristic flicks of the fingers. Woe betide his mother if she tried to tidy the pots up, shifting any of them by even the smallest degree, while Freddie was at school! The slightest rearrangement would instantly be noticed and rectified on his return.

So what is happening here? One might reasonably expect that blind children, in the absence of the visual input that would otherwise by their main source of information about the world around them, would be particularly attracted to salient features in the auditory landscape. One might also predict that, without the visual data to contextualise what is heard – to know *what* is making a particular sound and *why* – that at least some auditory information would remain at the perceptual level, rather an acquiring a functional gloss. Hence the whirr of the tumble-drier and the hum of the vacuum cleaner would remain as ends in themselves, as perceptual experiences to be relished, rather than portending dry laundry or a clean carpet. (And, as one would expect, a key element in supporting young blind children's development is to help them link what they hear with tactile input and, where appropriate, verbal explanation.)

But why do some children on the autism spectrum treat sound in the same way? Are there the same cognitive mechanisms at work here, or different ones that have similar consequences? For sure, a proportion of autistic children have problems in processing visual information, which may partly account for the tendency to behave in certain respects as though they were visually impaired. And many autistic children have difficulties with 'sensory integration': linking incoming data from different sensory modalities. That is, the processes through which incoming streams of perceptual information in the domains of sight, sound, touch, smell and taste (as well as balance and proprioception) are typically bound together to produce single, coherent experiences and concepts, appear not to be fully functional. One can speculate that this cognitive anomaly is linked to 'weak central coherence', in which, as we have seen, there is a tendency to focus attention on parts of things rather than wholes. So, in summary, a child on the autism spectrum may be facing the double challenge of finding it difficult to link information received in *different* sensory channels, as well as successively in *one* domain.

There can be a further consequence of the exceptional early cognitive environments that blindness and autism cause, which pertains to language: 'echolalia'. This feature of speech is widely reported among blind and autistic children, and was originally defined as the (apparently) meaningless repetition of words or groups of words. Echolalia can occur immediately after the language in question has been heard, or its reoccurrence may be delayed. Prizant and Duchan (1981) were among the first to observe that echolalia actually can fulfil a range of functions in verbal interaction, such as turn-taking and affirmation, and often finds a place in non-interactive contexts too, where it can serve as a self-reflective commentary or rehearsal strategy.

Why does echolalia occur? It is a feature of normal language acquisition in young children (one to two years old), when the urge to imitate what they hear outstrips semantic understanding. As we have seen, zygonic theory holds that imitation lies at the heart of musical structure, so one could argue that echolalia is the organisation of language (in the absence of semantics and linguistic syntax) through musical structure. It is as though the words (bearing little or no meaning) become musical objects, to be manipulated purely through their sounding qualities.

It is worth noting that even music can become 'super-structured' with additional repetition, as the account, for example, of Ben (p. XXX) shows: it is common for children on the autism spectrum to play snippets of music (or videos with music) over and over again. It is as though music's proportion of repetition (estimated to be 80%; see Ockelford, 1999) is insufficient for the mind ravenous for structure, and so it creates even more! Speaking to autistic adults who are able to verbalise why (as children) they would repeat musical excerpts in this way, it appears that the main reason (apart from the sheer enjoyment of hearing a particularly fascinating series of sounds again and again) is that they could hear more and more in the sequence concerned. Bearing in mind that most music is, as we have seen, highly complex, with many events occurring simultaneously (and given that even single notes generally comprise many pitches in the form of harmonics), to the child with finely tuned auditory perception, there are in fact many different things to attend to in even a few seconds of music, and many relationships between sounds to fathom. That is, while listening to a passage a hundred times may be extremely tedious to the 'neurotypical' ear, which can only detect half a dozen composite events, each fused in perception, to the mind of the autistic child, which can break down the sequence into a dozen different melodic lines, the stimulus may be rich and riveting.

Add music's self-referencing structure to the ubiquity of music in a child's environment (Lamont, 2008), and everything is in place for EECEs to develop. The elements in such development are modelled in Figure 10.3.

The key thing that transforms musical potential into advanced performing skills is *opportunity* – and, as we shall see, the opportunities that children on the autism spectrum require to progress musically may be different from those of their 'neurotypical' peers.

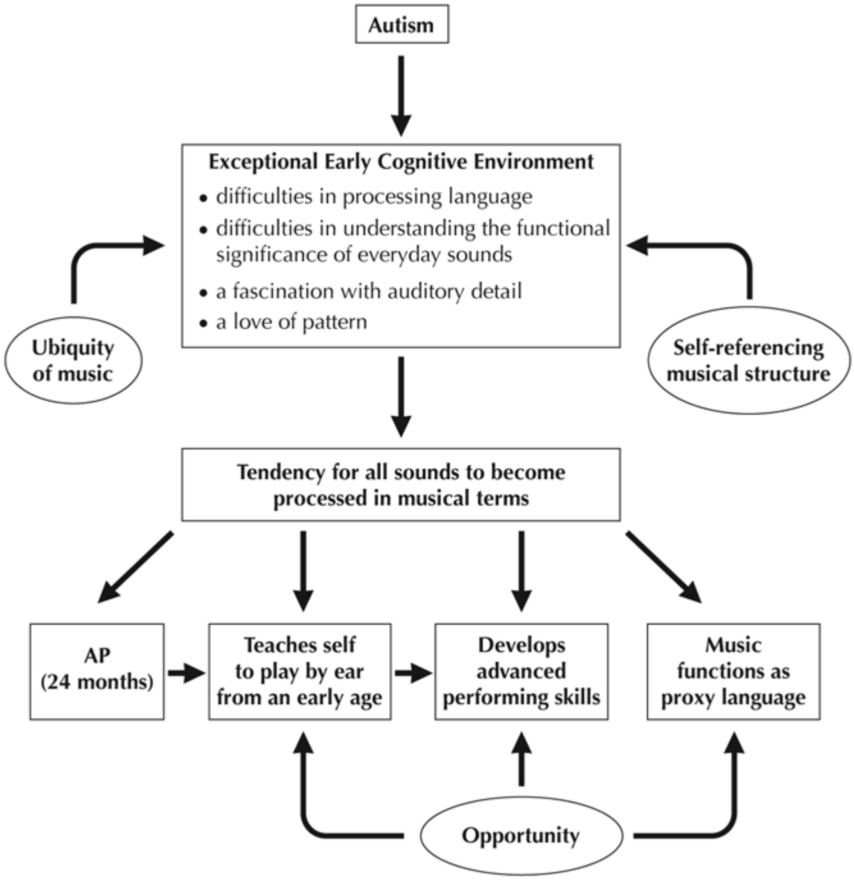

Fig. 10.3 The supposed impact of 'exceptional early cognitive environments' caused by autism on musical and wider auditory development

The Potential Consequences of EECEs for the Development of Music Performance Skills

Most children set out on the path of learning an instrument at the direction of their parents or teachers. In the Western classical tradition, the approach tends to be dominated by acquiring the knowledge and skills to decode notation, which is seen as an essential element of musicianship. Hence, the eye generally leads the ear. In fact, most children taught through traditional means never do learn to play by ear and are imprisoned by the stave, unable to play without dots on a page indicating what they should do.

However, for the great majority of children on the autism spectrum with AP, the ear leads the eye and the hand. I believe it is absolute pitch perception that drives them towards playing any instruments that they may find in their living or learning environments at home, in the nursery or at school – typically the keyboard or piano – something that very often

Fig. 10.4 Alfie's chant

occurs with no adult intervention. As Francesca Happé said recently at a Royal Society Lecture,[3] it is the autistic child's eye for detail (in this case, *ear* for detail) that kick-starts special talents. I would go further and say AP is the fire the fuels the acquisition of special skills in the domain of music. Here, we consider how the kick-starting and the subsequent fuelling of proactive musical engagement work.

Consider a 'neurotypical' child – Alfie – singing a playground chant, which he repeats from time to time, though not always starting on the same note (see Figure 10.4). That is to say, he has encoded and memorised the melodic motifs not as individual pitches in their own right, but as a series of differences between them.[4]

However, for children such as Romy (on the autism spectrum – see p. XXX), who has AP, the position is rather different, since she has the capacity to encode the pitch data from music directly, rather than as series of intervals. So in seeking to remember and repeat groups of notes over significant periods of time, she has a processing advantage over Alfie, since he has to extract and store information at a higher level of abstraction.

It is this that explains why children on the autism spectrum with AP are able to develop instrumental skills at an early age with no formal tuition, since for them, reproducing groups of notes that they have heard is merely a question of remembering a series of one-to-one mappings between given pitches as they sound and (typically) the keys on a keyboard that produce them. These relationships are invariant: once learnt, they service a lifetime of music making, through which they are constantly reinforced. Were Alfie to try to play by ear, though, he would have to master the far more complicated process of calculating how the intervals that he hears in his head map onto the distances between keys, which, due to the asymmetries of the keyboard, are likely to differ according to her starting point. For example, producing the interval between the first two notes of Alfie's song, a minor third, can be achieved through 12 distinct key combinations, comprising one of four underlying patterns. Even more confusing, though, virtually the same physical leap between keys may sound different (a major third) according to its position on the keyboard (see Figure 10.5).

For sure, many children with AP who learn to play by ear rapidly develop the skills to play melodies beginning on different notes too, and some, including a proportion of those with severe learning difficulties, are able to play fluently in every key (a capacity that, as a teacher, I strongly encourage). This may appear contradictory, in the light of the processing advantage conferred by being able to encode pitches as perceptual identities in their own right, each of which, as we have seen, maps uniquely onto a particular piano or organ key. But the reality of almost all pieces is that motifs variously appear at different pitches, and so to make sense of music, young children with AP need to learn to process pitch relatively as well as absolutely. This begs the question of how the two forms of processing evolve and interact in a child's musical development.

3 On 26 October 2011, entitled: 'When will we understand autism spectrum disorders?'

4 We can surmise, though, that absolute representations of pitch are not entirely absent for Alfie, since the notes he uses on separate occasions are broadly similar.

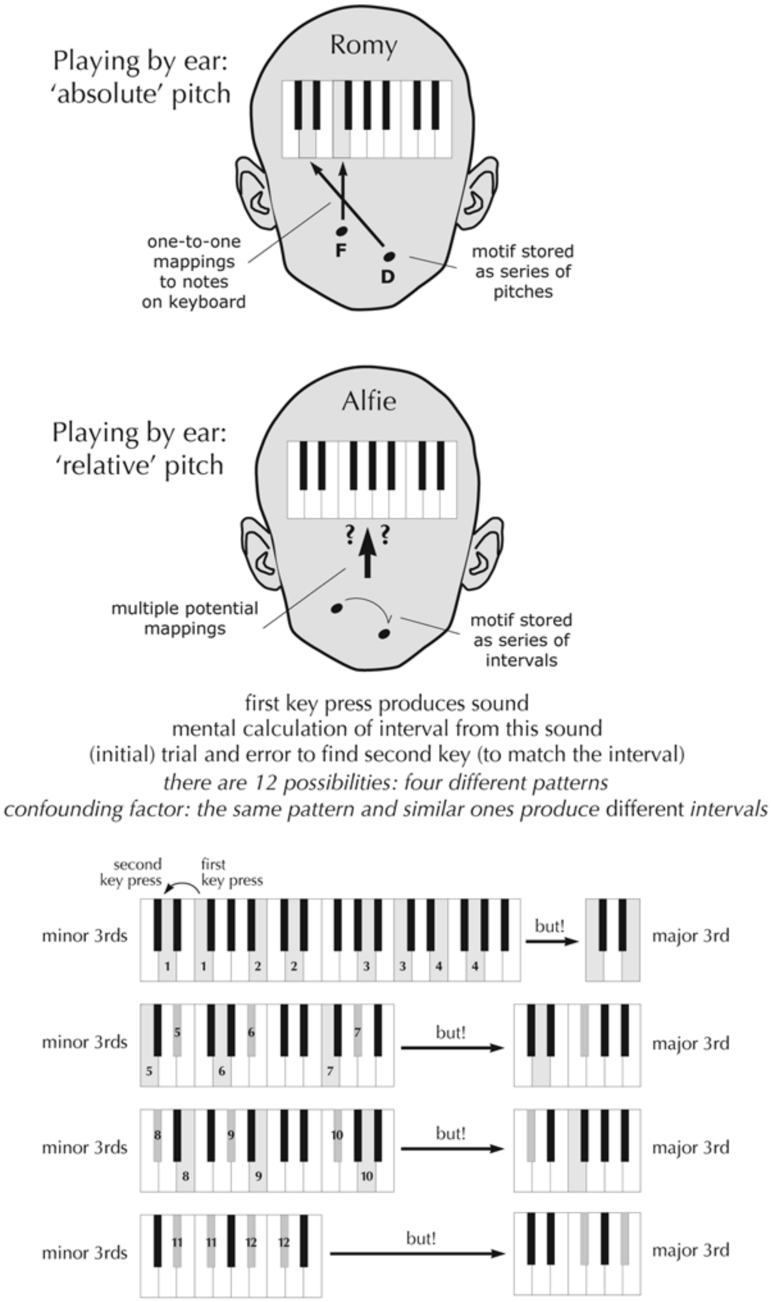

Fig. 10.5 Different mechanisms involved in playing by ear using 'absolute' and 'relative' pitch abilities

Fig. 10.6 A typical rendition of the *Vltava* theme in E minor by Romy

Let us take the case of Romy once more, who, at the time of writing, is 11 years old, and has a repertoire of around 100 song excerpts and fragments of other pieces from a wide range of styles that she enjoys using as material for improvised interactions on the piano. In re-creating these motifs, she largely plays the melody alone with the right hand, although she sometimes supplies a bass-line in the left, occasionally adding chords and, in the case of the opening of the theme from the second movement of Beethoven's *Pathétique* sonata, a moving inner part. Apart from being an utterly joyous musician with whom to work, Romy is fascinating from a music-psychological point of view because she does not always get things right, and it is in her pattern of errors that one can obtain a rare glimpse into the workings of an exceptional musical mind: in particular the relationship between absolute and relative pitch processing, which, in her case, is still evolving.

For example, one of her passions of the moment is the theme from *Vltava* by Smetana. I first played Romy the tune in E minor (the key in which it initially appears in the symphonic poem), and she quickly picked it up using her AP ability, invariably reproducing the outline of the melody correctly, sometimes adding new details of her own (see Figure 10.6).

This seems straightforward enough. But Romy is what can only be described as an obsessive transposer. She will very often play the same motif over and over again, frequently starting on a different note each time, and sometimes even changing key *within* a particular appearance of the musical fragment concerned. As she likes me to provide an accompaniment, the latter tendency is particularly challenging! It may be, though, that it is this very challenge that offers one possible explanation for Romy's maverick modulations, since they keep her firmly in control of the shared musical narrative. This is a subtle development of the influence that she previously had exerted through playing material in different keys to *prevent* me from joining in (Ockelford, 2012a). She is now content for me to participate in her creative flow provided that she feels in charge of what is happening.

Another reason, I believe, for Romy's constant key changes is the buzz she gets from hearing things that are at once well-known and novel: 'so familiar and yet so strange'.[5] Only someone with her powerful sense of AP could experience shifts of key in this way: she will often leap up and shriek with excitement as she hears the impact of a motif that she knows well appearing as a fresh set of pitches – seeing old friends in a new light. And yet, she sometimes makes mistakes that remain uncorrected at the time, and which are repeated on future occasions. For example, in her version of the introduction of the *Vltava* melody in F minor, she plays a B instead of a C; see Figure 10.7. This is a blatant error; observers in Romy's lessons notice it straight away.

It seems inconceivable that, at a certain level, Romy does not recognise that something is wrong, given her advanced music-processing abilities. Yet at the same time, we can assume that she *wants* to play things correctly (she very rarely makes mistakes, and is

5 See Wim Kayzer's book *Vertrouwd en a zo Vreemd: Over Geheugen en Bewustzijn* (which features an interview with Derek Paravicini; see p. XXX).

Fig. 10.7 Romy's uncharacteristic error as she transposes the *Vltava* theme

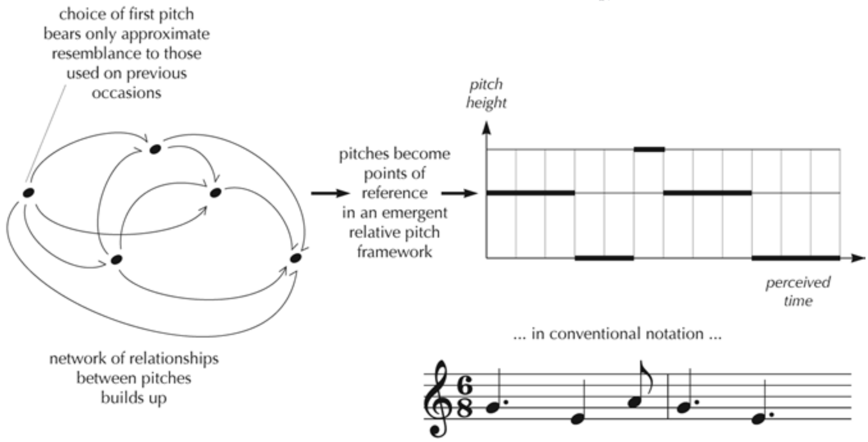

Fig. 10.8 A 'relative pitch framework' emerges from Alfie's production of his motif, beginning at an unspecified pitch level

somewhat intolerant of any changes that I may try to introduce within the accompaniments with which she is familiar). So what is going on?

To find out, let us take a step back and consider again Alfie and his musical motif. Since he reproduces the tune at different absolute pitches, we previously made the assumption that this information is encoded largely as differences in pitch. Now, imagine Alfie is at the stage of beginning to sing the first note. Without thinking, he chooses a pitch (which will approximate to the ones he has used in earlier renditions of the same motif). We can surmise that this will be stored in working memory and become a reference point for those that follow, functioning as a temporary 'absolute' in the domain of pitch. In much the same way, the second note will be retained, as a potential benchmark for others. Hence the third note will have two possible points of reference, the fourth three, and so on: the unfolding network of relationships creating an embryonic pitch framework through which the notes are mentally locked together (Figure 10.8). There are no conflicts, and the structure is self-sustaining.

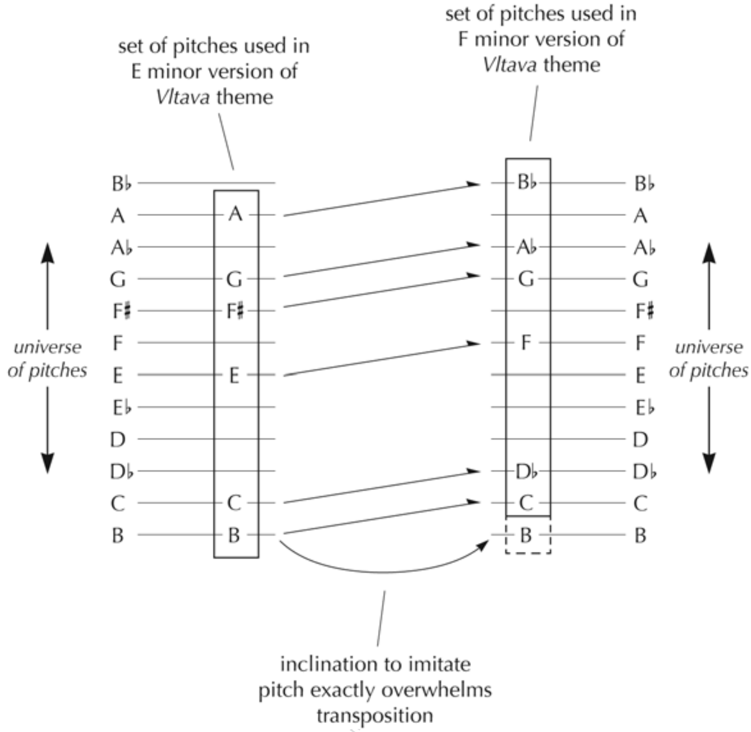

Fig. 10.9 The conflict between absolute memories recalled and transposed is thought to result in confusion and induce error

How does this differ from Romy's position? We know that she initially encoded the *Vltava* theme as a series of pitches pertaining to E minor (and therefore starting on an B). When retrieving the melody at this pitch level, the task appears (for her) to be straightforward, and she re-creates it without error (Figure 10.6): we can assume that she plugs into her absolute pitch memories (which are, of course, not unique to this melody) and reifies them on the piano.

It is not clear whether she *also* encoded the melody in relative terms, distinct from the 'absolute' memories, although, as we shall see, the error she makes throws this into doubt. Let us assume for the moment that the pitches were only stored as absolute values. Given a series of data in this form, there are two strategies that Romy could adopt when she tries to transpose. The first would be to draw into working memory her long-term recall of absolute pitches, and calculate a transposed version of each. Inevitably, this would produce interference, since the values being calculated anew would conflict with those being remembered, yielding the potential for confusion and – therefore – error. (See Figure 10.9.) Similar incompatibilities would arise if an attempt were made to extract information concerning intervals from the series of absolute pitches as they were recalled.

However, if relative data, in either of these two forms, were *dissociable* from the absolute, then conflicts would not arise, and, we can surmise, errors would be less likely.

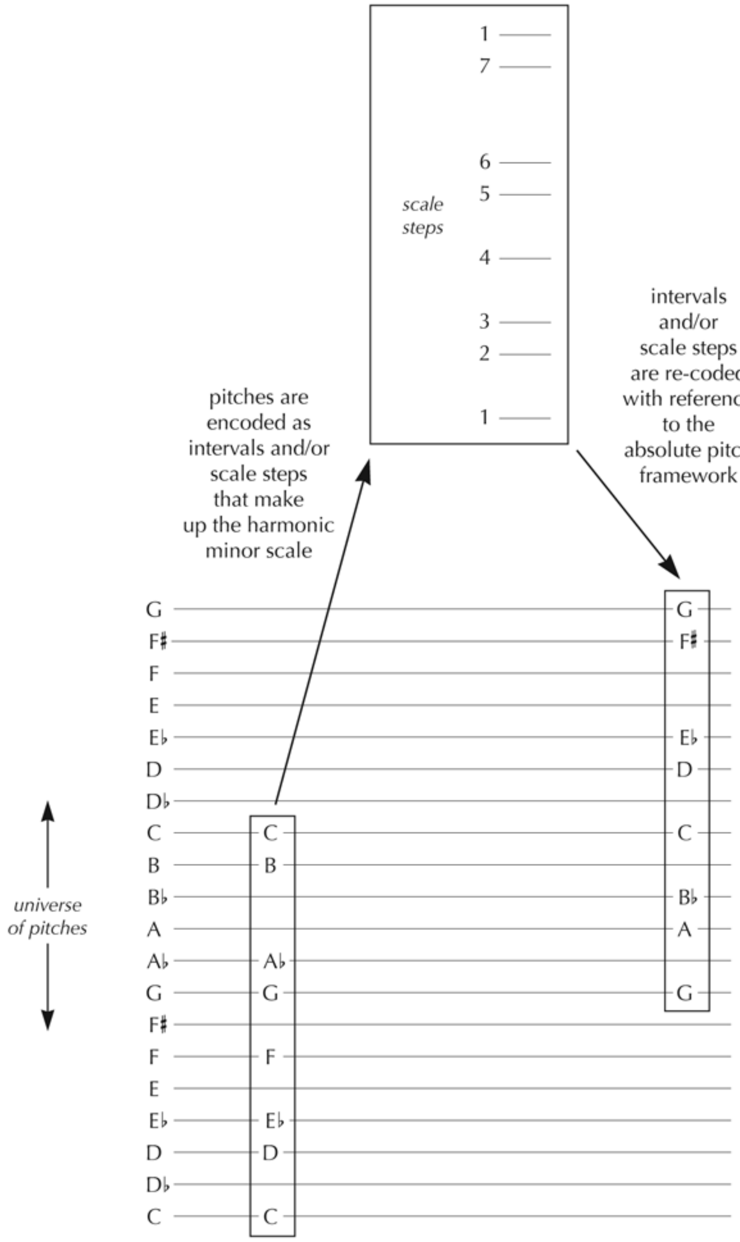

Fig. 10.10 Example of Freddie's hypothesised mental processing in transposing a scale

Hence, one explanation for Romy's mistakes in transposition may be a lack, or partial lack, of discrete relative encoding of pitch in her long-term memory.

Most children with AP sooner or later find ways of resolving the potential conflicts like this, between the 'absolute' and 'relative' encoding of pitch. Freddie (he of the flowerpots), for example, learnt to play major and minor scales in every key on the piano by ear – but he only required C major and minor as models. These provided him with the all the information he required. When asked to play the scales on other notes, I could hear him singing the next note that was required, and then finding the relevant key on the piano, which he did very rapidly since, as we have seen, his AP means that he knows precisely what each note sounds like. Any mistakes he made (largely due to difficulties with fingering, which he continues to learn much more painstakingly through physical demonstration and support) were immediately corrected. Hence we can assume that Freddie encoded the initial scale patterns on C absolutely, abstracted the necessary information about pitch differences from those traces, and subsequently drew on the this when transposing, plugging the nodes of the intervals back into his absolute pitch framework (at a different level from the original) (see Figure 10.10).

In summary, then, despite the conflicts that may arise from retrieving pitches encoded relatively and absolutely, there seems to be little doubt that the possession of AP offers a huge advantage to the musical development of children with autism and learning difficulties, for whom many of the more conventional ways of learning (through emulating peers working in social groups or through being taught using notation, for example) may not be available. In short, AP may well enable children to function at a higher musical level than they would otherwise be unable to do so, and, beyond this, it is AP that catalyses the exceptional achievement found in musical savants.

Consider, for example, Derek Paravicini, blind, autistic and with severe learning difficulties (see www.derekparavicini.net), whom I began teaching at the age of five. He had started to teach himself to play the piano at the age of two, and sharing the keyboard – which, for three years, had been his sole preserve – was initially an unfamiliar notion, as this account of my first attempt to work with him, having met him once before, shows:[6]

> As I had done at Linden Lodge, I reached forward and this time as gently as I could, started to improvise a bass-line below what he was doing. The notes were barely audible to me, but Derek was on to them immediately. His left hand shot down to where my fingers had trespassed, shooed the intruders away with a flick, and instantly picked up from where I had left off.
>
> Round 1 to Derek.
>
> Leaving my chair, I walked round to the other side of the piano and started improvising an ornamented version of the tune high up – as far away as I could from his right hand. In a flash he was there again, pushing my hand out of the way. Then once more he began imitating what I had just played before extending it to fit in with the changes in harmony.
>
> End of Round 2, and Derek was clearly ahead on points.
>
> Still, by following me to the extremes of the keyboard, he had left the middle range of notes temporarily exposed and, surreptitiously leaning over Derek's shoulders, with a feeling of mischievous triumph, I started to add in some chords. My victory was short-lived, however. Without for one moment stopping what he was doing, he tried to push me away with the back of his head. This time, though, I was minded to resist.

6 From my book, *In the Key of Genius: The Extraordinary Life of Derek Paravicini*.

> 'Do you mind if I join in, Derek?'
>
> My words fell on deaf ears. Ignoring me, he pushed with increasing force, all the time continuing to play. His message was unequivocal, so I decided to let him have his own way. For now. As soon as the coast was clear, his hands darted back to the middle of the piano, to fill in the chords that were now missing, before scampering outwards again to catch up with the abandoned tune and bass-line.
>
> 'You need an extra hand, Derek,' I joked, as in my mind I conceded Round 3 to him. By a knockout.

Matters of technique are likely to present a particular challenge to children with autism and learning difficulties, especially for those who begin by teaching themselves. For example, when he was very young, Derek, with very small hands but a huge determination to play the complex musical textures he could resolve aurally, used his wrists and even his elbows on occasions to play notes that would otherwise have been beyond his reach.[7] The main melodic line was typically placed in the middle of the texture and picked out with the thumbs, giving it a characteristic percussive prominence.

While technical idiosyncrasies such as these are ultimately neither 'right' nor 'wrong', certain methods of playing undoubtedly enable performers to fulfil their musical aims more effectively than others – indeed, some passages on the piano may even be rendered impossible unless a particular fingering is adopted. However, the prospect of changing aspects of a child's technique, which may have evolved wholly intuitively, can be daunting too. Those with severe learning difficulties may have little capacity to reflect consciously on what they do, and lack the receptive vocabulary to make description or analysis of their efforts meaningful. Moreover, the challenges they face may be compounded with physical disabilities. In circumstances such as there, teachers may opt for compromise: seeking to modify a pupil's technique only where it is judged to be essential; adopting, where appropriate, an evolutionary rather than a radical approach to change; and, in a positive way, acknowledging and accepting the effects on performance – technically, stylistically and in terms of repertoire – that a child's disabilities may have.

Teaching may have to rely to a great extent on demonstration (rather than explanation). This may be based on the pupil seeing, feeling or listening to what is going on, or a combination of the three. Listening, and seeking to emulate the quality of sound made by the teacher or other performers, may be a crucial factor in technical development too, since the pupil's desire to reproduce what is heard may encourage the necessary motor activity without needing conscious attention.

Whatever approach is adopted, the development of technique is likely to require many hours of painstaking work on the part of both teacher and pupil. For example, as a little boy, Derek tended to play passages of consecutive notes by jumping from one to the next using the same finger – or sometimes even a series of karate chops with the side of his hand! Despite the extraordinary dexterity this entailed, it was clear that his playing would benefit enormously from incorporating the standard finger patterns associated with scales and arpeggios.

> I decided to start with some five-finger exercises, the foundation of all keyboard technique: just up and down the keys, one note for each finger and the thumb. Would Derek find that

7 Eddie, the young savant with whom Leon Miller worked, apparently adopted the same approach! (See Miller, 1989, p. 30.)

sufficiently engaging? How would he react? But these questions were supplanted in my mind by a more immediate problem: how was I going to be able to get at the piano for long enough to play the notes that he was supposed to be copying?

Sitting next to him on the piano stool, I tried holding both his wrists with my left hand to give my right free rein on the keyboard. I reckoned that I only needed about ten seconds. But that was nine too many for Derek. He wriggled out of my grip in no time and struck the C that I had managed to play before being overwhelmed. I was afraid of hurting him if I held his wrists any tighter, so I had to try something else.

'Right, Derek,' I declared, 'we're going to play a game. You're going to sit over the other side of the room while I play something on the piano, then you can come over and see if you can copy it.'

I didn't really expect to him understand what I'd said, but in any case, without waiting to see his reaction, I picked him up and plopped him down on the floor at the far end of the nursery. I strode back to the piano and quickly played the five-finger exercise. I'd only just finished when Derek, who'd been amazingly quick out of the starting blocks and had fairly scuttled across the room, was pushing me out of the way. That done, he reached across the stool, and played what I had – well, a version of it. He used both hands to play a series of chords, up and down. I had to laugh at his antics.

Then he stopped, waiting. This was a game whose rules he had somehow immediately grasped.

So I picked him up again, sat him as far away as I could from the piano, raced back and played the exercise once more – this time starting on the next note up, C sharp. Again, my thumb was barely off the last key when Derek was back with his response.

And so we continued up the chromatic scale, until we'd tackled all twelve different keys. That brought us back to C, and it felt right to stop there. Derek seemed to sense that feeling of completion too, and he was content to return to his familiar routine of taking requests for pieces to play. He still wouldn't let me join in, I noticed, but I didn't mind: I was convinced that the five-finger-exercise game had provided the breakthrough that I had been looking for. Now I had something to build on.

It was then a short step in the lesson that followed to leave Derek where he was on the piano stool, and to engage in the 'play-copy' dialogue with no physical intervention on my part at all. In due course, I started to imitate what *he* was doing too, enabling us to have a genuine musical 'conversation'. And it wasn't just a matter of a musical ball bouncing between us like echoes in an alleyway. Whatever you lobbed at Derek would invariably come hurtling back with interest, and it was challenging to keep up with his musical repartee, which combined wit and ingenuity with an incredible speed of thought. With no words to get in the way, a whole world of sophisticated social intercourse was now opened up to him. It was the second 'eureka' moment of his life: having first discovered that he was able to play what he could hear, now he came to realise that he could communicate *through* music. Indeed, for Derek, music came to function as a proxy-language, and it was through music that his wider development was increasingly channelled.

However, Derek's fingering remained as eccentric as ever, and as he had no conceptual understanding of his thumbs and fingers as distinct entities, and was consequently unable to manipulate them appropriately in response to verbal direction, the problem of how to help him develop his technique remained. Although he could copy the notes that I played just by listening, he could not, of course, see how I held my hands at the piano, which fingers I used, and the fact that my elbows didn't figure at all in what I did!

To plug this gap in his experience, I tried putting his hands over mine, one at a time, so that he could feel the shape of my hand and, to an extent, what my fingers were doing. We tried it for a few weeks, but it didn't seem to make any difference: whenever it was his turn, Derek just carried on as before.

So I tried a different approach. I held his right hand on mine.

'Look, Derek, here's my thumb,' I said, giving it a wiggle as his fingers curled around it.

'Now, where's yours?' I guided him to feel his right hand with his left.

'That's it! Now, let's put your thumb on C, middle C.' He allowed me to help him find the correct note and to push it down with his thumb.

'There you are.' And I sang, 'thumb'.

Next I uncurled his index finger and placed its tip on D. He pressed the note.

'Second finger,' I sang.

And so we continued with his third, fourth and little fingers, before coming back down to the thumb. He sang along enthusiastically, and couldn't resist adding in an accompaniment below. When we swapped over to his left hand, he treated the five-finger exercise like a bass-line, and added tunes in the right. No matter, I thought. The main thing was that, for the first time in his life, he'd manage to play using something approaching a conventional technique. On that simplest of foundations we would subsequently be able to build.

Little did I appreciate at the time just how long Derek's technique would take to reconstruct. For a total of eight years we worked together, weekly and then daily, spending hundreds of hours physically going over all the basic fingering patterns that make up a professional pianist's stock-in-trade. From five-finger exercises we moved on to full scales: major, minor and chromatic, as well as some of the more exotic varieties – the so-called 'modals', the whole-tones and the octatonics. Scales had the additional complexity of requiring Derek to tuck his thumb under his fingers while his hand was travelling in one direction, and to extend his fingers over his thumb while it was coming back in the other. I had to use both my hands to help him get this action right. We also tackled arpeggios: major, minor, and dominant and diminished sevenths, followed by some of the more unusual forms – French sevenths, augmented triads and chords of the added sixth. Long after my threshold of boredom was a distant memory, Derek would be keen for more. There was something about the orderliness, not only of the scales and arpeggios themselves, but also the regular way in which they related to one another, that he clearly found deeply satisfying.

However, in spite of the tens – perhaps hundreds – of thousands of willing repetitions, Derek never did learn to tell which finger was which! And even today, if you ask him to hold his thumb up (rather than his fingers), he still can't do it reliably, and the capacity to distinguish one hand from the other continues to elude him. While this seems odd – incredible, even – given his dazzling virtuosity, with hindsight I've come to realise that being able to put a name to concepts such as 'left' and 'right' wasn't the most important thing. What really mattered was achieving that very first aim I identified when I initially watched Derek play: that his technique should develop sufficiently so as not trammel his vivid aural imagination. And that, over the years, is exactly what *did* happen. During all those hundreds of hours of practice he absorbed many of the standard fingering patterns, quite without being aware of it, and these slowly became assimilated into his own playing. Today his technique, as a mature adult performer, although still far from conventional, enables him to do whatever his musical imagination demands.

Children on the autism spectrum can perform with others more or less successfully, according to their levels of musical, cognitive and social development. They may show varying degrees of sensitivity to the fluctuating dynamics of a performing group. Some may be able to conceptualise and assume distinct roles; at different times consciously accompanying, for example, or taking the lead. The individuality of some young people may mean that they will always be more suited to solo performance. The greatest challenge in ensembles may be working together and making decisions using little or no language. Even relatively straightforward instructions such as 'play the final chorus twice' may have to be conveyed in purely musical terms. For example, an additional dominant seventh harmony may indicate that more is to come, whereas a slight slowing may show that the end is approaching:

> Working with a large group of children who couldn't see, many of whom had complex needs, presented a number of challenges for teacher and pupils alike. Clearly, conducting was out of the question, so starting and stopping, slowing down and speeding up, and making expressive changes or effects such as getting louder or softer had to be co-ordinated non-visually: through sound, using speech or musical cues. As I soon discovered, calling out what was required was disruptive, and in any case spoken instructions meant little to several of the children, including Derek, on account of their learning difficulties. So, during a performance, the direction of the group had to come solely through inflections in the piano part, to which the children learnt to listen very attentively. For example, if a verse were to be sung sadly, then the accompaniment might reflect this through a reduction in tempo and dynamics and, perhaps, by moving to the 'minor' key. Conversely, the return to a happy state could be conveyed through an increase in movement, loudness and the use of 'major' chords. It was even possible to communicate a sense of irony, which could be appreciated by some of the older and more able pupils, by juxtaposing different pieces with contrasting connotations together – for example, by playing fragments of *Day oh!* while the children were singing *Morning has broken*.
>
> The accompaniment could relay simpler messages too. For instance, if a chorus were to be repeated at the end, this could be signalled through particular chords that suggested there was more to come. From time to time I would link songs together by improvising a 'bridge' between them. Musically, this would borrow material from the first piece and incrementally transform it into the introduction to the second, so it gradually became apparent what this was to be. Sometimes the children would compete to see who could name the upcoming tune first. If things were becoming too straightforward, I would tease them by appearing to set off in a certain direction only to change course at the last moment. Increasingly, I was able to hold their attention by linking a whole sequence of pieces in this way. Indeed, I came to the conclusion that the most effective lessons were those in which there was little or no talking, and that the more one could teach music *through* music the better.

For those supporting autistic children, playing in concerts is likely to raise a number of practical questions, such as attendance at rehearsals, setting up instruments and behaving appropriately on stage. It is essential that these areas of potential concern are acknowledged in good time and adequately addressed. Other issues, such as facing the audience, learning not to move excessively while playing, and receiving applause appropriately may need special consideration – and rehearsal – too. A child with severe learning difficulties may find it far more difficult to raise or lower the piano stool than to play the instrument once seated! Here is an account of Derek's first public performance, aged eight:

He was rocking slowly on the piano stool, his fingers fidgeting in readiness for their forthcoming workout. He smiled when he heard his name, and sat still for a moment to give his full attention to what Miss Lingard was saying.

'… and now he's going to play the *Streets of London*.'

Derek's smile widened into a broad beam that stretched right across his face. This was the moment that he'd been waiting for.

I decided to assert my authority straight away – and to keep Derek on his toes – by beginning in E flat major, a key in which he had not, as far as I could remember, ever played the song. I couldn't think of another child (except, perhaps, Philip) for whom such an act wouldn't have had disastrous consequences. But for Derek, the unusual was commonplace, and I had complete faith in his ability to follow me. My confidence was well-founded, and before the opening chord had faded away he was there alongside me, as though it were the most natural thing in the world to play a piece in an unfamiliar key before his first ever public audience. The hundreds of hours that we had spent practising all conceivable scales and arpeggios had refined his raw capacity to realise his entire repertoire starting on any note, and he was now equally at home playing pieces in any key – rather like being able to speak twelve languages with native fluency.

I led Derek resolutely through the first verse and chorus of the *Streets of London* and he obediently followed. I was longing to let him go in order to see just where his musical imagination, fired up by the excitement of the occasion, would take us, and as soon as I judged it was prudent to do so – towards the end of verse two – I gradually retreated into the background with a series of *sotto voce* chords. The instant that he sensed my musical grip was released, Derek was off, scampering up the octave with a series of broken chords. Up and up he took the music, ascending into higher and higher realms of musical invention. Just when it seemed as though he was going to run out of notes at the end of the keyboard, he came scurrying down in a series of tumbling scales and rejoined me in the middle register. Seizing my opportunity, I took the lead again and introduced a new syncopated rhythm in the bass. Without a moment's hesitation, his left hand too started skipping along to the new beat before he broke free once more, dancing out of my reach.

And so our pas de deux continued for a few minutes, until it felt appropriate to draw matters to a close, before Derek ran out of steam and his perambulations became repetitive. An almost imperceptible reduction in the pace of my accompaniment signalled that it was time to wind things up, and he fell back into step with a series of expansive chords that served as an effective climax to the piece. He held on to the last *fortissimo* cluster of notes waiting for me to lift my hands up first, and then he couldn't resist his trademark final plonk low down in the left hand.

The audience burst into rapturous applause – this was quite unlike anything they'd ever seen or heard before. There were shouts of 'Well done, Derek!' He was quivering with excitement, his face radiant, his hands alternately clapping and flapping energetically at his sides. I looked across at Nanny. She too was applauding vigorously, her eyes shining with pride. I felt relieved, delighted and (I had to admit) vindicated. From somewhere, Derek seemed to have acquired the instincts of a natural performer: a sense of occasion and the capacity to rise to it, the ability to communicate with an audience and a feeling of exhilaration when his playing was acknowledged. These were things that could not be taught, but with them, Derek's playing had the potential to reach heights that were as yet unexplored.

Finally, we consider a question that I am often asked in relation to music-making by children on the autism spectrum: do they *feel* the music in the same way as their 'neurotypical' peers? This is a complex issue. Consider, for instance, the case of Milán, a teenager on the autism spectrum and with severe developmental delay, who is lead singer in his pop group at school. When he performs *Thank You for the Music* by ABBA, he slows down before the return of each chorus for expressive effect. As Milán normally displays little or no emotion in everyday life, his teacher questions whether he actually understands the music on an emotional level and, if so, whether it is this affective engagement that drives the change of tempo; or (his teacher wonders) is it merely a device that Milán has copied unthinkingly from Agnetha Fältskog's performance with ABBA that he has accessed on YouTube. Evidence for the latter view comes from the fact that, although Milán uses similar conventions of Western musical expression in other songs, they always appear to match recordings that he has heard rather closely. And, as far as his teacher is able to ascertain, Milán does not transfer the interpretative gestures he reproduces in one context to novel scenarios.

Other performers, such as Derek Paravicini, in whom it is similarly possible to discern only a limited range of emotions in day-to-day life, seem to have taken the next step. Derek has learnt the 'emotional syntax' of expressive performance in a range of styles with which he is familiar: that is, he has acquired a repertoire of expressive devices that he can apply to new music in a rule-based way at appropriate points to communicate different feelings. For example in the documentary about him, *The Musical Genius* (originally screened in 2005 on Channel 5 in the UK and Discovery Health in the US), I created a short sequence of chords on the computer that, in terms of performance, were devoid of any expressivity at all. However, in conversation with the music psychologist John Sloboda, Derek showed that he was able to convey different emotions (joy, sorrow and – least convincingly – anger) through improvising on the series of chords in different ways, which included the introduction of expressive devices (such as changes in dynamics and tempo) as well as structural alterations (including the introduction of the minor key).

On viewing the programme, a number of people have asked the same question that Milán's teacher was keen to answer, to the effect of: 'Derek may be able to convey emotion in his playing (he has evidently learnt the "code" of expressive performance), but does he *feel* it himself?' Ultimately, since Derek has very limited powers of metacognition, this issue may remain unresolved. However, there are two points that I think are worth making in this regard.

The first is, does it matter? Derek loves playing *for other people* (he rarely, if ever, plays at his own instigation for his own amusement), and since his performances bring him and his audience pleasure, is it critical to have a precisely shared message? Or is the fact that positive communication takes place (even if the message as transmitted and received is somewhat different) the important thing? This highlights an issue that is problematic for all performers: since music exists only in the ear of the beholder so, by definition, does musical *meaning*, and it is inevitable that in any live musical engagement, performers and members of the audience will experience subtly (even, on some occasions, radically) different things.

The second point is that Derek, and others like him, may come to learn about their own feelings *through music,* which they may then recognise in everyday life (rather than via the more common route of experiencing reactions to people and events, which are subsequently felt to be conveyed by music). Such responses may occur directly, as when Derek *feels* emotion as he listens to music (just as 'neurotypical' listeners do), or indirectly: for example, when he performs with others, and detects a communicative intent in the way they play or sing – intentions that may be confirmed verbally (cf. Emanuele, Boso, Cassola, Broglia, Bonoldi, Mancini, Marini & Politi, 2009; Molnar-Szakacs & Heaton, 2012).

Conclusion

In this chapter we have explored some of the extraordinary musical journeys of young children with autism, and how the exceptional early cognitive environment that typically poses challenges in terms of communication and socialisation may also offer advantages in terms of auditory perception and the processing of musical structure. The key thing is that children on the autism spectrum are given the opportunities to explore their musical interests and to fulfil their musical potential, whatever that may be, since such achievements are likely not only to be intrinsically satisfying and to promote well-being in their own right, but may well also promote the very communication and social skills whose development the children's autism initially inhibited. That is, education *in* music and education *through* music are both likely to be essential ingredients in the pedagogical mix.

As the examples in this chapter illustrate, if there is a golden rule in working with children with autism, it is that there are no golden rules! I remain suspicious of any system or approach that claims to offer the best for all, or even the majority, of children, since the spectrum of their abilities, needs, propensities, motivations, likes and dislikes is so wide. That is not say, of course, that teachers should not in time develop longer-term aims (taking into account the views of parents and other significant figures in a child's life), and have to hand a battery of potential strategies (at least some of which will hopefully be tried and tested in other contexts) to support the child in moving forward. But to approach music education with a severely autistic youngster with a more or less fixed plan is likely to be a frustrating experience for all concerned. Indeed, it may do more harm than good.

So what approach should teachers take? Above all, listen, listen … and listen again. Open your ears to whatever children do, whether exploring or playing the instrument that they have chosen (or have been presented with), or vocalising, or moving. They may even seem to do nothing at all, or they may engage in apparently random behaviours. I am convinced, however, that everything a child does (or fails to do) occurs (or fails to occur) for a reason. So be sensitive; be empathetic.

Having said there are no golden rules, I am about to make an exception: *don't talk too much* (if at all)! Language is so often a barrier or, worse, a threat or, at best, auditory clutter. (Be prepared, though, to listen carefully to anything the child may choose to say to you.) Save verbal interaction for the parents, after the lesson – which, unless there are exceptional circumstances, I believe they should attend. The relationship you may develop with their child through mutual, enjoyable musical engagement is far too precious to keep to yourself. It must be seen as a stepping-stone to a wider and hopefully deeper, purposeful connection with others.

References

Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: The MIT Press.

Baron-Cohen, S. (2000). Theory of mind and autism: A fifteen year review. In S. Baron-Cohen, H. Tager-Flusberg & J. Donald (Eds), *Understanding other minds: Perspectives from developmental cognitive neuroscience* (2nd ed.) (pp. 3–20). New York, NY: Oxford University Press.

Baron-Cohen, S. (2009). Autism: The empathizing–systematizing (E–S) theory. *Annals of the New York Academy of Sciences*, The Year in Cognitive Neuroscience, 1(156), 68–80.

Baron-Cohen, S., Leslie, A. & Frith, U. (1985). Does the autistic child have a 'theory of mind'?. *Cognition*, 21(1), 37–46.

Bondy, A. & Frost, L. (2011). *A picture's worth: PECS and other visual communication strategies in autism* (2nd ed.), Bethseda, MD: Woodbine House, Inc.

Boucher, J. (2009). *The autistic spectrum: Characteristics, causes and practical issues*. London: Sage Publications Ltd.

Dale, N. & Salt, A. (2008). Social identity, autism and visual impairment (VI) in the early years. *British Journal of Visual Impairment*, 26(2), 135–46.

Emanuele, E., Boso, M., Cassola, F., Broglia, D., Bonoldi, I., Mancini, L., Marini, M. & Politi, P. (2009). Increased dopamine DRD4 receptor and mRNA expression in lymphocytes of musicians and autistic individuals: bridging the music-autism connection. *Activitas Nervosa Superior Rediviva*, 51(3–4), 142–5.

Frith, U. (2001). Mind blindness and the brain in autism. *Neuron*, 32(6), 969–79.

Frith, U. (2003) *Autism: Explaining the enigma* (2nd ed.). Oxford: Blackwell Publishing.

Frith, U. & Happé, F. (1994). Autism: Beyond 'theory of mind'. *Cognition*, 50(1–3), 115–32.

Gaver, (1993). What in the world do we hear? An ecological approach to auditory event perception. *Ecological Psychology*, 5(1), 1–29.

Happé, F. (1995). *Autism: An introduction to psychological theory*. London: UCL Press Ltd.

Happé, F. (1996). Studying weak central coherence at low levels: Children with autism do not succumb to visual illusions, *Journal of Child Psychology and Psychiatry*, 37(7), 873–7.

Happé, F. & Booth, R. (2008). The power of the positive: Revisiting weak coherence in autism spectrum disorders. *The Quarterly Journal of Experimental Psychology*, Special Issue: A Festschrift for Uta Frith, 61(1), 50–63.

Hill, E. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, 8(1), 26–32.

Hobson, P. (1993). *Autism and the development of mind*. Hove, East Sussex: Lawrence Erlbaum Associates.

Hobson, P. & Lee, A. (2010). Reversible autism among congenitally blind children? A controlled follow-up study. *Journal of Child Psychology and Psychiatry*, 51(11), 1235–41.

Kayzer, W. (1995) *Vertrouwd en a zo Vreemd: Over Geheugen en Bewustzijn*. Amsterdam: Uitgeverij Contact.

Lamont, A. (2008). Young children's musical worlds: Musical engagement in 3.5-year-olds. *Journal of Early Childhood Research*, 6(3), 247–62.

Miller, L. (1989). Musical savants: Exceptional skill in the mentally retarded. Hillsdale, NJ: Lawrence Erlbaum.

Miller, O. & Ockelford, A. (2005). *Visual needs*. London and New York: Continuum.

Molnar-Szakacs, I. & Heaton, P. (2012). Music: A unique window into the world of autism. *Annals of the New York Academy of Sciences, The Neurosciences and Music IV, Learning and Memory*, 1(252), 318–24.

Ockelford, A. (1999). *The cognition of order in music: A metacognitive study*. London: Roehampton Institute.

Ockelford, A. (2005a). *Repetition in music: Theoretical and metatheoretical perspectives*. London: Ashgate.

Ockelford, A. (2005b). Relating musical structure and content to aesthetic response: A model and analysis of Beethoven's Piano Sonata Op. 110. *Journal of the Royal Musical Association*, 130(1), 74–118.

Ockelford, A. (2007). *In the key of genius: The extraordinary life of Derek Paravicini*. London: Hutchinson.

Ockelford, A. (2009). *Zygonic theory: Introduction, scope, prospects*. Zeitschrift der Gesellschaft für Musiktheorie, 6(1), 91–172.

Ockelford, A. (2012a). Songs without words: Exploring how music can serve as a proxy language in social interaction with autistic children. In R. MacDonald, G. Kreutz and L. Mitchell (Eds), *Music, health, and wellbeing* (pp. 289–323). Oxford: Oxford University Press.

Ockelford, A. (2012b). Applied musicology: Using zygonic theory to inform music psychology. *Education and Therapy Research*. Oxford: OUP.

Ockelford, A. (2013). *Music, language and autism*. London: Jessica Kingsley.

Ockelford, A. & Matawa, C. (2009). *Focus on music 2: Exploring the musical interests and abilities of blind and partially-sighted children with retinopathy of prematurity*. London: Institute of Education.

Ockelford, A., Pring, L., Welch, G. & Treffert, D. (2006). *Focus on music: Exploring the musical interests and abilities of blind and partially-sighted children with septo-optic dysplasia*. London: Institute of Education.

Ockelford, A., Welch, G., Jewell-Gore, L., Cheng, E., Vogiatzoglou, A. & Himonides, E. (2011). Sounds of Intent, Phase 2: Approaches to the quantification of music-developmental data pertaining to children with complex needs. *European Journal of Special Needs Education*, 26(2), 177–99.

Pring, L. (Ed.) (2005). *Autism and blindness: Research and reflections*. London: Whurr Publishers.

Prizant, B. & Duchan, J. (1981). The functions of immediate echolalia in autistic children. *Journal of Speech, Language and Hearing Research*, 46(3), 241–9.

South, M., Ozonoff, S. & McMahon, W. (2007). The relationship between executive functioning, central coherence, and repetitive behaviors in the high-functioning autism spectrum. *Autism*, 11(5), 437–51.

Tager-Flusberg, H. (2001). A reexamination of the theory of mind hypothesis of autism. In J. Burack, T. Charman, N. Yurmiya & P. Zelzao (Eds), *The development of autism: Perspectives from theory and research* (pp. 157–75). Mahwah, NJ: Lawrence Erlbaum Associates.

Turner, M. (1997). Towards an executive dysfunction account of repetitive behaviour in autism. In J. Russell (Ed.), *Autism as an executive disorder* (pp. 57–100). New York, NY: Oxford University Press.

Vogiatzoglou, A., Ockelford, A., Welch, G. & Himonides, E. (2011). Sounds of intent: Interactive software to assess the musical development of children and young people with complex needs. *Music and Medicine*, 3(3), 189–95.

Welch, G., Ockelford, A., Carter, F-C., Zimmermann, S-A. & Himonides, E. (2009). Sounds of intent: Mapping musical behaviour and development in children and young people with complex needs. *Psychology of Music*, 37(3), 348–70.

Wing, L. (2003). *The autistic spectrum: A guide for parents and professionals* (2nd ed.). London: Robinson Publishing.