Learning and creativity in a prodigious musical savant

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Abstract. Preliminary findings are presented of work undertaken with a prodigious 'savant' pianist – Derek Paravicini – in which he learnt a specially-composed piece (*The Chromatic Blues*) over a number of hearings. All Derek's efforts were recorded digitally, which enabled precise transcriptions to be made. These were analysed in the context of a newly-developed theory of how musical structure is recognised and understood. The results are startling in musicological terms and (it is hypothesised) yield fascinating insights into the subtlety, ingenuity and creativity of Derek's musical mind. It is hoped that the findings from this study will in due course inform the wider debate on the nature of musical learning, memory and creativity.

Keywords: musical learning, creativity, savant, musical structure, Blues.

1. Introduction

This paper presents initial findings from a study that forms part of the 'REMUS' Project – 'Researching Exceptional MUsical Skill' – which is a joint initiative of the Royal National Institute of the Blind, London and the Psychology Department of Goldsmith's College, University of London. The project focuses on the abilities of musical 'savants': people with exceptional skill in the context of learning disabilities. The current study was undertaken with Derek Paravicini, 25, a prodigiously skilled pianist, despite have severe learning difficulties and being totally blind (through 'retinopathy of prematurity'). It is one of a series of studies that aims to glean new insights into the nature of savants' musical ability, in particular learning, memory, reproduction and creativity, and to use these findings to generate models of the processes involved, adopting a fusion of music-psychological and music-theoretical approaches [1]. The underlying methodological assumption is that the musical pieces and fragments that savants produce following exposure to controlled musical input – specifically the extent to and manner in which their responses can be considered to derive from the stimuli with which they are presented – provide powerful evidence of the cognitive processes involved [2]. In the longer term, it is intended that our findings will be used to underpin new didactic approaches in working with savants (and others), inform the wider debate on the nature of musical ability in general and stimulate further research.

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2. Method

A piece was especially composed for the experiment which was entitled *The Chromatic Blues* – 'CB', whose structure is as follows (a score and digital recording of this and other material cited in the paper are available from the first author).

segment	$A_{1.1}$	$B_{1.1}$	$A_{2.1}$	$B_{2.2}$	C
function	Theme A – exposition	Theme B – exposition	Theme A – reprise	Theme B – transposed	Coda
tonal regions	I → (V of ii)	♭VII → V	I → (V of ii)	♭III → V	i
range (beat.bar)	0.4 – 4.3	4.4 – 8.3	8.4 – 12.3	12.4 – 16.4	17.0 – 20.4
excerpts analysed	Excerpt 1 0.4 – 2.3	Excerpt 2 4.4 – 6.4	Excerpt 3 8.4 – 10.3	Excerpt 4 12.4 – 14.4	Excerpt 5 18.4 – 20.4

Fig. 1. Structure of *The Chromatic Blues.*

Statistically, CB comprises 312 events occuring within 49 seconds (an average rate of 6.37 events per second). The opening four bars are as follows:

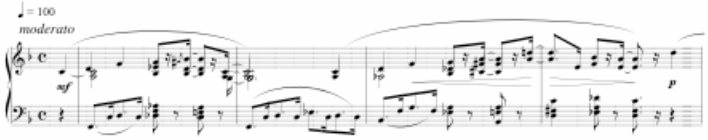


Fig. 2. Opening bars of *The Chromatic Blues* (© Adam Ockelford, 2003).

CB was presented to Derek over a number of sessions which were structured as follows:

a) Derek plays CB as well as he is able (in all except the first session)
b) Derek listens to CB
c) Derek plays CB (again)
d) Derek listens to CB again

All material was performed on a Korg touch-sensitive keyboard SP-200 (using 'Piano 1' sound), recorded as MIDI and digital sound files, and reproduced using the same system. The pattern of sessions is shown in Figure 3.

3. Results

Derek's first attempt at playing CB (immediately having heard it for the first time) began as follows (Figure 4). Overall, this version ('CB-D1') was derived from CB with a strength of derivation of 0.31 (using the excerpts for analysis set out in Figure 1) [1].

Session number	*Trials*	*Days since previous session*	
1	1.ii	–	
2	2.i & 2.ii	2	
3	3.i & 3.ii	5	≈ 2 weeks
4	4.i & 4.ii	2	
5	5.i & 5.ii	7	
6	6.i & 6.ii	25	≈ 1 month
7	7.i & 7.ii	2	
8	8.i & 8.ii	5	≈ 2 weeks
9	9.i & 9.ii	2	
10	10.i	5	
11	11.i & 11.ii	96	≈ 3 months
12	12.i & 12.ii	xxx	≈ 6 months
Total	**22**	**yyy**	**≈ 11 months**

Fig. 3. Pattern of sessions with Derek and *The Chromatic Blues*.

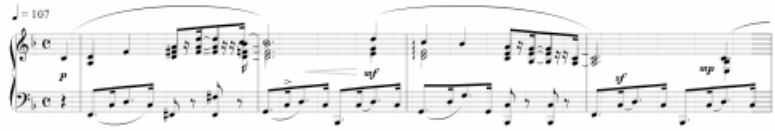


Fig. 4. The opening four bars of Derek's first attempt at *The Chromatic Blues* ('CB-D1').

As this excerpt illustrates, it is a feature of Derek's playing (rather like a natural language speaker) that what he produces invariably makes musical sense. As he was asked to play CB as well as he could, because he achieved a derivation index of only 0.31, we can assume that the piece was beyond the capacity of his working memory and that he was forced to modify, introduce or create material to 'plug the gaps'. It appears that he did this, quite intuitively, in a number of ways. First, within the general style of the opening of CB (including tonality, metre and phrase structure) he utilised a number of subtle transformations of its musical material, including re-ordering fragments, and separating pitch and rhythmic elements and re-combining them in new ways. Second, he appeared to introduce material from other pieces in similar style including the 'bass riff' found in bars 1 and 2 (typical of Count Basie, for example), whose harmonic structure is based on a common 'Blues turnaround', with the opening four bars outlining a design reminiscent of the chorus of *Paper Moon*. It is extremely doubtful that these apparent borrowings were part of Derek's conscious thinking, but they give an insight into the possible nature of his nonconscious musical processing that was in train.

Derek's next effort at reproducing CB (in Session 2, which was separated from Session 1 by two days) resulted in a further version ('CB-D2') that was comparable to, though distinct from, CB-D1. Having heard CB again, Derek then reverted to CB-D1. In Session 3 (after a further 5 days) he returned to CB-D2 (see Figure 5). However, his

second attempt in this session revealed a distinct and audible transition from CB-D1 to a rendition much closer to CB (Figure 6).

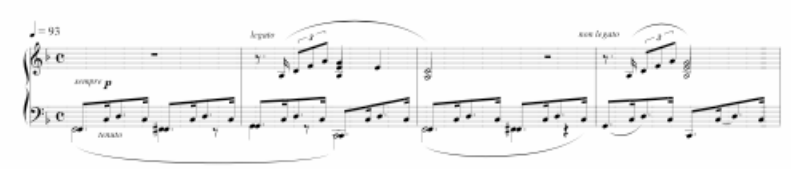


Fig. 5. The opening four bars of CB-D2.

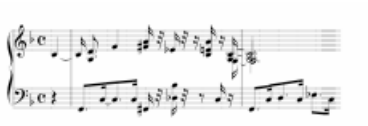
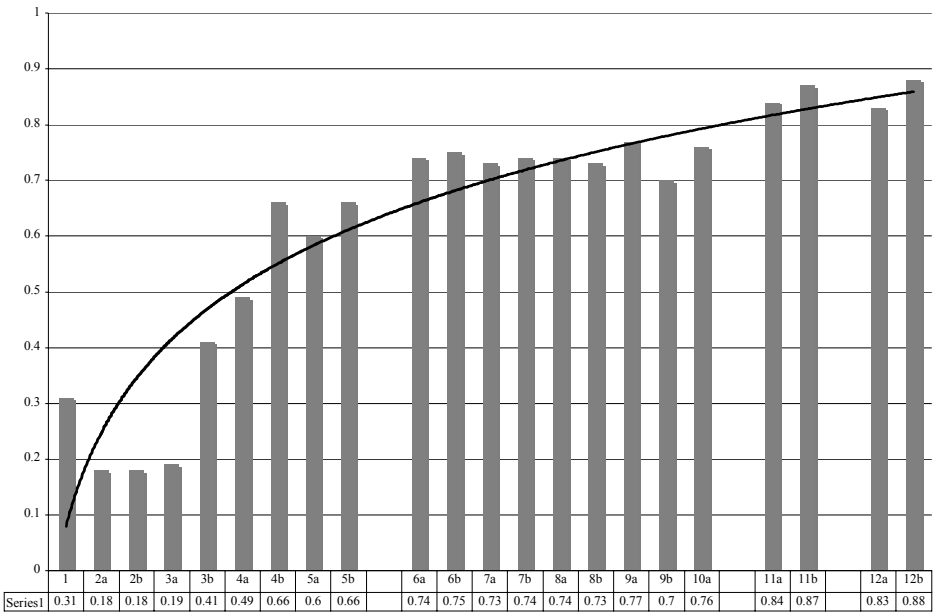


Fig. 6. The audible switch in rendition 7 from CB-D1 to CB.

The indices of derivation that Derek achieved over the entire period are as follows (see Figure 8). It is worthy of note that there are marked improvements following the first break of a month (0.66 to 0.74) and 3 months (0.76 to 0.84), and that even following the six months break, a level of 0.83 is achieved, followed by the highest score of all (0.88) at the second attempt in that session. For reference, an exponential trend is indicated.



	1	2a	2b	3a	3b	4a	4b	5a	5b		6a	6b	7a	7b	8a	8b	9a	9b	10a		11a	11b		12a	12b
Series1	0.31	0.18	0.18	0.19	0.41	0.49	0.66	0.6	0.66		0.74	0.75	0.73	0.74	0.74	0.73	0.77	0.7	0.76		0.84	0.87		0.83	0.88

Fig. 7. Derek's indices of derivation for CB over the test period (12 months).

4. Discussion

These preliminary data from 'REMUS Study 1' reveal a number of findings that are of interest. First, it is evident that Derek does indeed have an exceptional memory. Another jazz pianist (who, like Derek, had absolute pitch and was used to learning pieces by ear) attempted to learn CB under precisely the same conditions and, although his data await full analysis, it is evident that his performance was significantly inferior to Derek's. However, Derek's recall was by no means straightforward: musical analysis suggests that initially he was able to remember only certain salient fragments and features – details within an overall outline of what had occurred. Derek's instinct to produce something that made musical sense subsequently drove him to manipulate what he could remember, whereby the moment-to-moment demands of musical coherence apparently took precedence over his powers of recall. Transformations of material from CB were made as well as the introduction of fragments and features from stylistically congeneric sources (memories of which hearing CB had evidently stimulated in Derek).

Interestingly, analysis of data beyond this paper indicates that the most potent source of material for Derek at any given juncture was not CB itself (even immediately after having heard it), but his previous renditions, suggesting a strong interference effect. This was particular marked in the early stages of learning, when, as we have seen, three different versions of CB were maintained in parallel. Indeed, in renditions 7 and 9, Derek used CB-D2 as an introduction to a convincing performance of CB itself!

Clearly, then, Derek's developing model(s) of CB were far more than a series of surface percepts which he was able to reproduce, automaton-like at the keyboard. Evidently, despite his inability to verbalise almost anything about his musical achievements, Derek has a lively and engaging musical mind with considerable strengths but with human frailties too. His efforts are informed by an intuitive understanding of musical syntax and structure that would do credit to any mature musician. His ability to take material from a range of sources and mould it in real time into something that is of musical value in its own right indicates a genuine creativity that merits further research. And, following completion of the current study, it is to this area that the REMUS project will turn its attention.

References

[1] Ockelford A. Repetition in music: Theoretical and metatheoretical perspectives. London: Ashgate.

[2] Sloboda J. Exploring the musical mind: Cognition, emotion, ability, function. Oxford: Oxford University Press, 2005.

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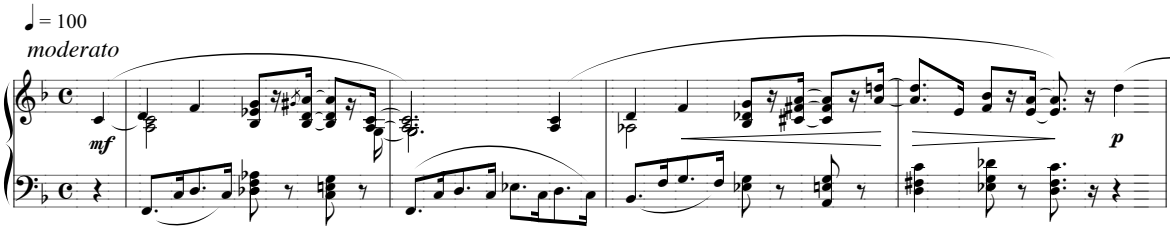

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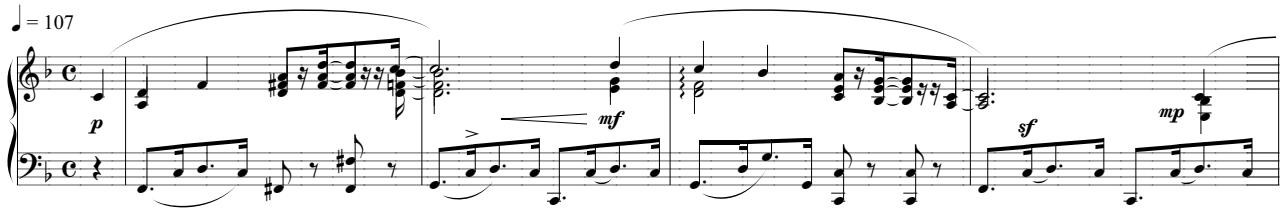

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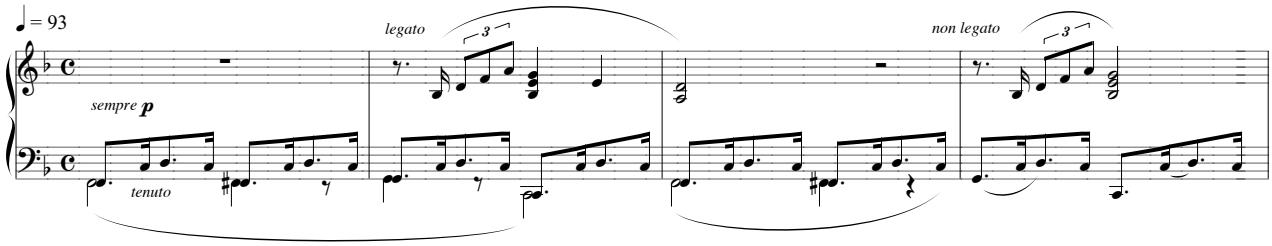

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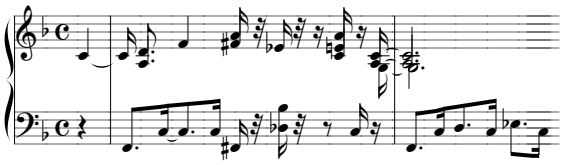

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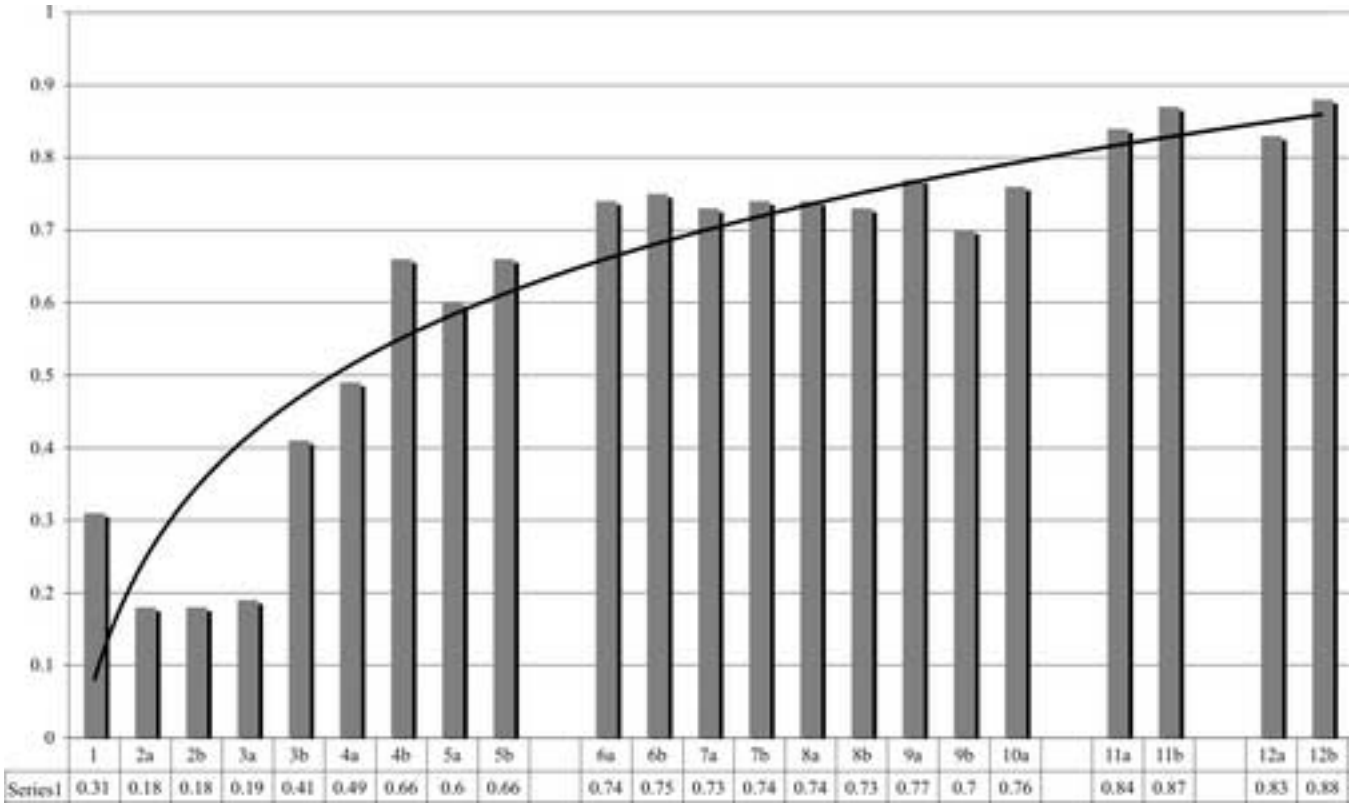

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Series1	0.31	0.18	0.18	0.19	0.41	0.49	0.66	0.6	0.66		0.74	0.75	0.73	0.74	0.74	0.73	0.77	0.7	0.76		0.84	0.87		0.83	0.88