

## **Practice thoughts and performance action: Observing processes of musical decision-making**

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**ABSTRACT:** This study explores how a group of violinists make musical decisions by inducing a variety of decision-making processes in three conditions: sight-reading, practising, and performing. The study aimed to distinguish between intuitive and deliberate processes as defined by default-interventionist forms of dual process theories of cognition (Evans, 2011). The participants were seven Baroque violinists trained in historically informed performance to varying degrees. The task involved playing a short piece of solo Baroque violin music and included the providing of retrospective and concurrent think-aloud data. Comparison of score markings and verbal data made while sight-reading, practising and performing showed that decisions categorised as intuitive (not planned during practice) accounted for approximately 82% of the total decisions coded. The category of deliberate decisions (planned during practice) included a subset labelled 'deliberate not executed' to describe deliberate decisions that were not perceptible in the final performance. Decisions regarding musical features such as articulation, bowing, phrasing, note duration, ornamentation and tempo were more likely to be intuitive than deliberate, while decisions about dynamics and chord playing were often the product of deliberate processes. More experienced participants made significantly more decisions than less experienced participants, and the most experienced also made a greater proportion of deliberate decisions.

**KEY WORDS:** Performance, decision-making, intuitive, deliberate, Baroque

Performing musicians communicate their understanding of a score by varying psychoacoustic and musical features (Juslin, Friberg, & Bresin, 2002; Juslin & Timmers, 2010; Friberg, Bresin, & Sundberg, 2006; Palmer, 1989, 1997; Repp, 1992; Seashore, 1938/1967; Todd, 1985). Depending on the musical context, the features varied may include tempo, articulation, loudness, rhythm, timbre, and ornamentation. The literature on musical expression discusses the ways such variations contribute to the individuality and expressive power of performances, but pays little attention to the question of how to observe and categorise the types of decision-making involved. Clarke (2005) has distinguished between “expressive features of performance which can be regarded as the unconscious *symptoms* of underlying cognitive processes, and those which are the result of deliberate interpretative choices” (p. 160). Similarly, Thompson (2009) suggests that “some aspects of performance expression do appear to be intentional acts of communication, whereas others seem to arise without conscious intention as a consequence of cognitive and affective processes operating within the performer” (p. 189). How might these broad distinctions between the unconscious and intentional be further explored?

To address this question, the present study employed a theoretical framework based on dual process theories of cognition (Evans, 2008). These theories distinguish between Type 1 and Type 2 processes, defined by Evans (2012, p. 18) as follows:

Intuition (Type 1) is fast and automatic, giving rise to feelings of confidence in answers or decisions but with no conscious knowledge of the basis of these feelings. Reflective processing (Type 2) is slower, involving manipulation of representations through working memory, at least part of which appears to be consciously accessible. However, reflective processing does not necessarily override or correct intuitions: it often confabulates justifications for them.

In the present study we use the term ‘intuition’ for Type 1 and ‘deliberation’ for Type 2 to retain consistency with our previous research (e.g., Bangert, Fabian, Schubert, & Yeadon, 2014) and recent psychological literature (e.g., Betsch, 2008; Betsch & Iannello, 2010; De Vries, Holland, & Witteman, 2008; Dijkstra, Van der Pligt, & Van Kleef, 2013; Dijkstra, Van der Pligt, Van Kleef, & Kerstholt, 2012). Within dual process theories, Evans (2011, p. 93) has distinguished between parallel-competitive (e.g., Sloman, 1996; Smith & DeCoster, 2000) and default-interventionist forms (e.g., Evans, 2007; Hogarth, 2001; Kahneman & Frederick, 2002; Stanovich, 1999, 2010):

*Parallel-competitive (PC) theories* assume that Type 1 and 2 processes proceed in parallel, each having a say. If they conflict, some mechanism is needed to resolve the conflict. *Default-interventionist (DI) theories*, on the other hand, assume that Type 1 processing produces a rapid and intuitive default response, which may or may not be intervened upon by subsequent Type 2 reasoning which is slower and deliberative in nature. Theories of the latter form are more common in the study of reasoning and decision making.

In addition, Evans (2011, p. 95) has proposed an Intervention Model to explain when Type 2 reasoning intervenes upon Type 1 responses and suggests that “Type 2 processing is engaged with a *variable* degree of effort” determined by motivational factors and cognitive resources.

In the present study we applied a default-interventionist understanding of Type 1 and Type 2 processes to observe and analyse the decision-making of professional Baroque violinists while sight-reading, practising and performing. In order to capture their thought

processes, the participants were asked to provide concurrent think-aloud verbal protocols (Ericsson & Simon, 1993) while practising and retrospective protocols after sight-reading and performing.

While previous researchers have analysed decision-making using data obtained concurrently from practice and retrospectively following performance (e.g., Chaffin & Imreh, 2001; De Graaff & Schubert, 2011), we used a novel method: categorising decisions made while performing as deliberate (marked in the score or commented on during practice) or intuitive (neither marked nor commented on). This relies on a number of assumptions. We assumed that sight-reading (playing without having practised first) captures initial, rapid responses to the musical score and that these responses are wholly intuitive in nature. These assumptions derive from the default-interventionist view that default responses are the result of Type 1 processes. In addition, sight-reading is a time-pressured task requiring immediate decision-making, and according to Evans (2011, p. 96), “speeded tasks reduce Type 2 intervention.” While response-type (intuitive or deliberate) can be influenced by time constraints (Hodgkinson, Langan-Fox, & Sadler-Smith, 2008, p. 18; Horstmann, Hausmann, & Ryf, 2010, pp. 224-226), the effect of time pressure may vary with participant expertise and task complexity. Therefore, decisions made while sight-reading are not necessarily, but are most likely to be, intuitive. By contrast, decisions made during practice and reported in think-aloud protocols or represented by score markings were made within weak time constraints. These decisions were assumed to be wholly deliberate: choices and plans based on Type 2 processes of analysis and reflection. While we could not rule out the possibility of errors and other unforeseen events occurring, the final performance task was predicted to contain both deliberate decisions planned during practice and intuitive decisions that were unplanned.

By focusing on Baroque violinists, the present study also contributes to the literature on historically informed performance (HIP). HIP attempts to recapture the style and character of performances from the period in which the music was written and typically involves deliberate choices regarding historically appropriate instruments and playing techniques. As Haynes (2010) notes, “I think when we talk about HIP, what we are really talking about are performing styles that no longer exist naturally, but must be deliberately and consciously revived” (15:46-15:57). While this quotation implies deliberation, we have shown through case study research with a Baroque cellist that HIP musicians also employ intuitive processes to make spontaneous performance decisions and access procedural knowledge (Bangert et al., 2014). To summarise, in the present study we aimed to observe and categorise musical decisions made by Baroque violinists using a novel, relatively implicit method of categorisation informed by dual process theories of cognition (Evans, 2011).

## METHOD

### Participants

Professional Baroque violinists were approached to take part in the study (University of New South Wales ethics approval number 082142). The seven violinists who participated had an average of 5.7 years of training in Baroque performance practice (range: 1-10, *SD* = 6.6). Training was defined as the number of years since they started taking regular lessons on Baroque violin. There were five female and two male participants, with an average age of 31

years (range: 22-40,  $SD = 3$ ). The results of a pilot study with one violinist are reported elsewhere (Bangert, Schubert, & Fabian, 2009).

The seven participants were divided into three “expertise” groups (E1, E2 and E3) according to their training and experience. Participants in the first group (E1a and E1b) had more than five years of Baroque violin training and regular employment in period instrument ensembles. Participants in the second group (E2a and E2b) also had more than five years of Baroque violin training, but only casual employment in period instrument ensembles. Those in the third group (E3a, E3b and E3c) had less than five years of Baroque violin training and only casual employment in period instrument ensembles.

### **Materials and apparatus**

The piece used in the study was the Grave from *Assaggio in C minor* BeRI 310 for solo violin by the Swedish composer Johan Helmich Roman (1694-1758). As Principal Conductor of the Royal Orchestra in Stockholm from 1727 to 1745, Roman is considered one of the most important figures in Swedish music of the Baroque period. Roman’s *Assaggi* (essays, attempts, experiments) are structured like sonatas of three or four movements and were composed mainly during the 1730s (Bengtsson & Frydén, 1958/1976, p. vi).

The piece was selected, first, for its technical and musical challenges similar to those likely to be encountered by Baroque violinists in their professional practice and second, because participants were not likely to be familiar with this specific piece. Participants were told that the piece was a Baroque composition, but all confirmed that they had not seen, played, or heard the piece before.

In order to leave basic directions to the performer intact while providing opportunities for varied musical decision-making on more complex issues of interpretation, the score given to participants did not identify the composer’s name or include expressive markings such as dynamics and ornamentation, but did retain bowings and the initial tempo indication of ‘Grave’ (see Appendix A). The aim of our observation of participants sight-reading, practising and performing was to enable us to infer the bases on which they made decisions in the absence of complete information from the score.

Each session undertaken by participants was video-recorded for the purposes of transcription and analysis using a Canon XHA1 High Definition video camera with RODE Stereo VideoMic, a MacBook Pro laptop, and a Zoom H4 digital recorder for audio backup.

### **Procedure**

Each participant undertook a single session in which they first sight-read, then practised and finally performed the piece. Instructions for providing retrospective (following sight-reading and performing) and concurrent think-aloud verbal protocols (while practising) were based on Renwick (2008).

First, participants were given up to 30 seconds to look at the piece and then asked to sight-read it. When they had done so, they were asked if they had seen, played, or heard this piece of music before. None had. Participants were then instructed to provide a retrospective think-aloud protocol:

I’d like you to watch the video of yourself sight-reading and tell me what’s happening. You might see something on the video that reminds you of what you were thinking at the time. I want you to tell me everything that you remember thinking when you were

playing, even things that seem irrelevant, trivial or obvious. You don't need to explain or speak in complete sentences: just think aloud. You are welcome to pause or rewind the video at any time.

While thinking aloud, participants had access to the score and the researcher (first author) asked brief questions about the thought processes being verbalised such as "can you explain that further?" or clarifying questions such as "what do you mean?" Specific questions about intuitive or deliberate processes of decision-making were avoided.

Second, participants were given up to 45 minutes to practise the piece in private and instructed to provide a concurrent think-aloud protocol:

When I leave the room you will have up to forty-five minutes in which to practise the piece and mark the score, after which you will be asked to perform the piece as if to an audience as part of a solo recital. During your practice, speak whatever is on your mind as if talking to yourself. Try to articulate what you are thinking now instead of thinking for a while and then describing your thoughts. If you fall silent for an extended period of time I may prompt you to keep talking. You don't need to justify things and you don't need to speak in complete sentences: just think aloud.

While score markings provided data for analysis, the aim of asking participants "to practise the piece and mark the score" was primarily to ensure that participants' behaviour was typical of their usual practice.

Third, when the participant had completed their practice session, they were asked to perform the piece as if to an audience as part of a solo recital. Participants were then instructed to provide a second retrospective think-aloud protocol.

### **Data preparation**

The data derived from three scores for each participant in each of the three conditions: sight-reading (SR), practising (P), and performing (PF). The practice score was the one used by and marked by participants while practising. The sight-read and performance scores were unmarked scores annotated by the first author while listening closely to the audio-recordings and watching the video-recordings. The annotations indicated features of the participant's playing that were perceived to deviate from the score. The first author repeated this process two weeks after the initial annotation to confirm his annotations and make alterations if necessary. Score markings and think-aloud data identified by location (bar.beat) were then tabulated, as shown in Table 1.

Categorisation of performance decisions was based on Evans's (2012) distinction between intuitive decisions made without, and deliberate decisions made with conscious awareness. This approach is potentially biased towards coding as deliberate since performers may not be able to articulate explicit reasons for marking the score, but doing so indicates awareness of decision-making. Decisions indicated by P score markings or concurrent think-aloud data were therefore categorised as 'deliberate' or 'deliberate not executed'. Following default-interventionist models of dual process theories (Evans, 2011), performance decisions neither marked in the P score nor commented on during practice were categorised as 'intuitive'. The data from the retrospective think-aloud protocols provided by participants after sight-reading and performing were used only as a validity check for the coding process.

**Table 1.** Excerpt from data for Participant E1a

Bar	Sight-reading (SR)		Practising (P)		Performing (PF)		Decision type
	SR score	Retrospective verbal protocol	P score	Concurrent verbal protocol	PF score	Retrospective verbal protocol	
10.3	down bow		up bow symbol	“the third beat needs to be light so I'll do it on an up bow”	up bow		Deliberate
29.2	first two semi-quavers slurred				first two semi-quavers slurred		Intuitive
47.4	no ornament				two demisemi-quavers added before last crotchet	“I don't know why I suddenly I start putting a couple of ornaments in there”	Intuitive
59.3	down bow		up bow symbol		down bow	“should have been an up bow”	Deliberate not executed
63.4	slight rit.		rit. marked by wavy line over 63		slight rit.		Deliberate

## RESULTS AND DISCUSSION

### Categories of decision-making

Three types of decisions made while performing were inferred from the data derived from the PF score and retrospective verbal protocol as shown in Table 1, since sight-reading was assumed to reflect wholly intuitive, and practising wholly deliberate processes:

1. Intuitive – neither marked nor commented on during practice
2. Deliberate – marked or commented on during practice
3. Deliberate not executed (subset of deliberate) – score markings or performance intentions verbalised during practice that were not executed or were not perceptible to the researcher in the final performance.

Participants made a total of 551 performance decisions, of which approximately 82% ( $N = 451$ ) were classed as intuitive and 18% ( $N = 100$ ) deliberate. Within the latter group, 33 were not executed. Specific examples of intuitive and deliberate decisions are discussed below.

### Musical features

Decisions made while sight-reading and performing related to eight musical features (articulation, bowing, chord playing, dynamics, note duration, ornamentation, phrasing and tempo), as shown in Table 2. Decisions could be intuitive (Columns 3-4), deliberate (Columns 7-8), or deliberate not executed (Columns 9-10). They could be the same in performance as while sight-reading (Columns 3, 7 and 9) or different (Columns 4, 8 and 10).

The largest proportion of decisions relating to a particular musical feature, measured as a percentage of the total, concerned bowing (276/551 or 50.1%): a typical “basic” feature of performance on a string instrument (Chaffin, Lisboa, Logan, & Begosh, 2010, p. 10). As Participant E3a commented, “I guess my decisions were based mainly on just getting the physics of it, like being able to play the notes. I guess most of my focus was on that rather than musical aspects for me.” This particular finding supports longitudinal case study research by Chaffin and his colleagues showing that musicians tend to focus on basic (e.g., ‘technical’) and structural features of the music (e.g., noting section boundaries) while both undertaking and commenting on early practice sessions (Chaffin, Imreh, & Crawford, 2002; Chaffin, Imreh, Lemieux, & Chen, 2003). It makes sense for musicians to focus on basic issues particularly when the piece is technically difficult, as in the present study, and when they have limited practice time.

**Table 2.** Intuitive and deliberate decision-making by musical feature

Decision type	Total	Intuitive (I)		I total	I % of total	Deliberate (D)		D not executed		D total	D % of total
		Same	Diff.			Same	Diff.	Same	Diff.		
PF vs. SR											
Articulation	49	16	24	40	81.63	2	3	0	4	9	18.37
Bowing	276	96	143	239	86.59	10	16	3	8	37	13.41
Chord playing	12	0	4	4	33.33	3	5	0	0	8	66.67
Dynamics	21	0	8	8	38.10	0	2	0	11	13	61.90
Note duration	70	65	1	66	94.29	3	0	1	0	4	05.71
Ornamentation	46	17	22	39	84.78	2	5	0	0	7	15.22
Phrasing	59	14	26	40	67.80	8	6	0	5	19	32.20
Tempo	18	6	9	15	83.33	1	1	0	1	3	16.67
Total	551	214	237	451	81.85	29	38	4	29	100	18.15

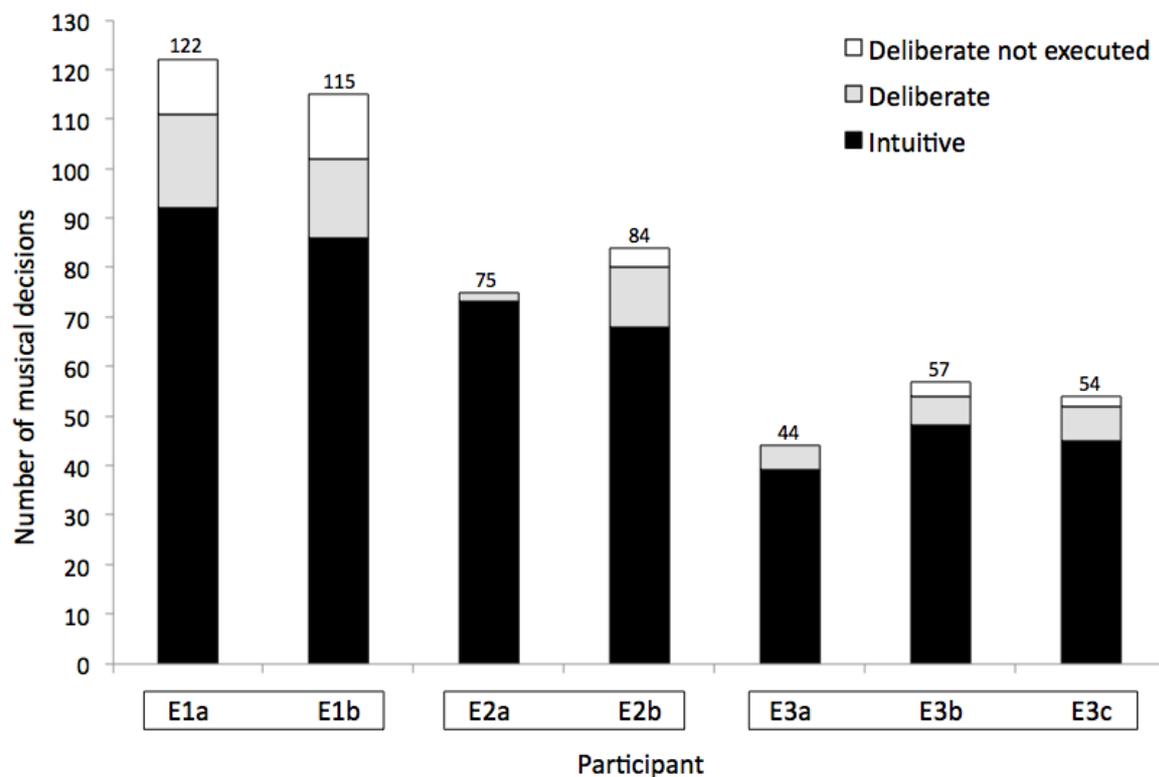
**Table 3.** Chi-square analysis of musical features

Musical feature	<i>N</i>	$\chi^2$	<i>p</i>
Articulation	49	19.61	< .001
Bowing	276	147.84	< .001
Chord playing	12	1.33	1.00
Dynamics	21	1.19	1.00
Note duration	70	54.91	< .001
Ornamentation	46	22.26	< .001
Phrasing	59	7.47	.05
Tempo	18	8.00	.04

Chi-square analysis with Bonferroni correction for multiple comparisons showed that decisions regarding articulation, bowing, note duration, ornamentation and tempo were significantly more likely to be intuitive than deliberate, whether executed or not (see Table 3). Phrasing decisions were also usually made intuitively, but chord playing and dynamics were more often the result of deliberate processes.

### Individual participants

The total number of decisions made by each participant ranged from 44 (E3a) to 122 (E1a), but in general, the preferred method of musical decision-making was an intuitive process requiring no observed conscious deliberation (see Figure 1). On average 83.5% of each participant's decision-making was intuitive and 16.5% deliberate, reflected in the percentages for all participants taken together as a group: 82% intuitive and 18% deliberate. Figure 1 shows the numbers of decisions made by each participant of each type and overall.



**Figure 1.** Performance decisions by participant.

The results suggest that some of the variance between participants may be due to levels of expertise. Chi-square analyses with Bonferroni correction for multiple comparisons showed that the most experienced participants (E1a and E1b) made significantly more decisions in total, regardless of type, than less experienced participants (E2a and E2b),  $\chi^2(1, N = 396) = 15.36, p < .001$ , and significantly more deliberate decisions,  $\chi^2(1, N = 77) = 21.83, p < .001$ . The less experienced participants (E2a and E2b), in turn, made significantly more decisions in total, regardless of type, than the least experienced participants (E3a, E3b and E3c),  $\chi^2(1, N = 314) = 14.80, p < .001$  (see Table 4 for numbers and proportions by individual participant).

**Table 4.** Performance decisions by participant

Participant	Total	Intuitive (I)	I % of total	Deliberate (D)	D not executed	D % of total
E1a	122	92	75.4	19	11	24.6
E1b	115	86	74.8	16	13	25.2
E2a	75	73	97.3	2	0	02.7
E2b	84	68	81.0	12	4	19.0
E3a	44	39	88.6	5	0	11.4
E3b	57	48	84.2	6	3	15.8
E3c	54	45	83.3	7	2	16.7
Total	551	451	81.85	67	33	18.15

**Decisions made while sight-reading and performing**

As shown in Table 5, approximately 55% of the 551 decisions made by all participants while performing were different from those that had been made while sight-reading. Only Participant E1b made more ‘Same’ than ‘Different’ decisions when performing and it may be that this performer has developed the ability to draw on informed, appropriate solutions to musical problems even when sight-reading. If such decisions, made intuitively, were judged to be musically satisfying and accompanied by a strong “feeling of rightness” (Thompson & Morsanyi, 2012; Thompson, Turner, & Pennycook, 2011), it is likely that these decisions would be repeated in a performance given after a short practice period.

**Table 5.** Decisions made while sight-reading and performing by participant

Participant	Total	Same (S)	S % of total	Different (D)	D % of total
E1a	122	52	42.6	70	57.4
E1b	115	60	52.2	55	47.8
E2a	75	35	46.6	40	53.4
E2b	84	36	42.8	48	57.2
E3a	44	15	34.1	29	65.9
E3b	57	25	43.8	32	56.1
E3c	54	24	44.4	30	55.6
Total	551	247	44.83	304	55.17

Of the 304 ‘Different’ decisions made while performing, 237 (78%) were categorised as intuitive rather than deliberate (see Table 2). These decisions may represent mistakes made while sight-reading that were corrected in performance, or they may be examples of spontaneous decision-making in performance (Ginsborg & Chaffin, 2011; Ginsborg, Chaffin, & Demos, 2012). Over the practice period, as performers became more familiar with the style and details of the music, their intuitions may have changed; in addition, the performer may have been experimenting with alternative interpretations.

### Intuitive decision-making

To reiterate, the majority (82%) of performance decisions, overall, were categorised as intuitive. Participant E2a made the largest proportion of intuitive decisions (73/75 or 97.3%) and spoke very little during practice. In their retrospective verbal protocol after performing, E2a described their response to the music as follows: “Obviously, I am technically doing stuff but I think I am doing what emotionally it feels to me.” This participant went on to acknowledge having difficulty in explaining how they went about making musical decisions:

I suppose when I say emotionally, it’s probably just like a feeling. Does it feel sad? The music sort of says it itself and maybe that’s totally what I’m going by. I’m not sure. I’m not great with words.

As shown in Table 2, ornamentation was a musical feature for which a particularly high proportion of decisions were made intuitively (85%). While the vast majority of bowing and note duration decisions were also taken intuitively (87% and 94% respectively), ornamentation is an area that highlights important individual differences.

As can be seen in Figure 2, the source score included nine trills, all removed for the purposes of the study. Trill signs (*tr*) in Figure 2 indicate where participants added a trill and the sign has been emboldened (***tr***) if it was added at the same place as in the source score. Two participants (E3a and E3c) made no decisions regarding trills. Two (E2a and E3b) added trills only while performing, and the remainder added them while sight-reading and performing.

Bar	2.3	6.4	12.3	17.3	21.1	29.2	31.3	40.3	41.1	44.4	46.4	48.2	52.4	58.4	61.4	62.2	63.4
Roman				<b><i>tr</i></b>	<b><i>tr</i></b>		<b><i>tr</i></b>		<b><i>tr</i></b>	<b><i>tr</i></b>	<b><i>tr</i></b>		<b><i>tr</i></b>	<b><i>tr</i></b>		<b><i>tr</i></b>	
E1a SR	<i>tr</i>											<i>tr</i>				<b><i>tr</i></b>	
E1a PF								<i>tr</i>								<b><i>tr</i></b>	
E1b SR	<i>tr</i>	<i>tr</i>						<i>tr</i>	<b><i>tr</i></b>	<b><i>tr</i></b>	<b><i>tr</i></b>				<i>tr</i>		<i>tr</i>
E1b PF	<i>tr</i>	<i>tr</i>	<i>tr</i>		<b><i>tr</i></b>	<i>tr</i>		<i>tr</i>	<b><i>tr</i></b>	<b><i>tr</i></b>	<b><i>tr</i></b>				<i>tr</i>		<i>tr</i>
E2a SR																	
E2a PF		<i>tr</i>															<i>tr</i>
E2b SR																	<i>tr</i>
E2b PF		<i>tr</i>															<i>tr</i>
E3a SR																	
E3a PF																	
E3b SR																	
E3b PF		<i>tr</i>								<b><i>tr</i></b>	<b><i>tr</i></b>						<i>tr</i>
E3c SR																	
E3c PF																	

**Figure 2.** Decisions regarding trills by participant while sight-reading (SR) and performing (PF).

Differences between the number of decisions made while sight-reading and performing may relate to individual preferences; for example, some performers leave ornamentation until they are familiar with the piece. Differences in decision type (intuitive or deliberate) may also reflect experience; both of the most experienced (E1a and E1b) and one of the less experienced participants (E2a) made their decisions about trills intuitively, while the less and least experienced participants (E2b and E3b) marked their decisions in the score. Differences regarding the placement of trills may relate to experience in historically

informed performance (HIP); only one of the least experienced participants (E3b) added a trill at the same location as in the source score, while both the most experienced participants did so. Trills were most often placed on the fourth beat of bars 6 and 63 where the same music closes a section.

As well as trills, more elaborate ornamentation was sometimes added by participants in sections of the score that are relatively sparse and simple, such as bars 32-34. Figure 3 shows transcriptions of Participant E1b's spontaneous embellishments in these bars for comparison with those in the three commercial recordings currently available (by Jaap Schröder [1986, *Caprice*], Peter Csaba [1994, *Chamber Sound*], and Tobias Ringborg [1999, *Nytorp Musik*]).

Figure 3 displays six musical staves, each representing a different performance of bars 32-34 from the 'Grave' movement of *Assaggio in C minor* (BeRI 310). The staves are labeled as follows: Roman (original score), Schröder (1986 recording), Csaba (1994 recording), Ringborg (1999 recording), E1b while sight-reading, and E1b while performing. The Roman staff shows the original notation. The Schröder staff includes a trill (tr) on the second beat. The Csaba staff includes trills (tr) on the second, fourth, and sixth beats. The Ringborg staff includes a sixteenth-note run (6) on the second beat. The E1b while sight-reading and E1b while performing staves show a sixteenth-note run on the second beat.

**Figure 3.** Grave from *Assaggio in C minor* BeRI 310, bars 32-34.

The fact that E1b added numerous trills and embellishments while both sight-reading and performing suggests that a highly developed sense of ornamentation is part of their playing style. This participant made the largest number of decisions about ornamentation (25 in total including 11 about trills), all of which were categorised as intuitive. In their retrospective verbal protocol after performing, E1b stated:

I can't really describe how I formulated it, but you have general ornaments that you like to use I think or I have used before in pieces and some of them come more naturally to me than others and so when playing a particular figure, I just add them in when I feel like it. It just happens. It feels purely intuitive. I didn't decide. I decided to ornament some sections but you know, it just happened.

The quotation above describes the results of the process whereby learnt behaviour becomes automatic. When presented with a new piece in a recognisable style, performers identify places where a type of ornament can be added and adapt a suitable ornament to fit the specific context. The ornaments that “come more naturally” to an experienced Baroque violinist such as E1b are those that have become familiar through playing or hearing similar embellishment in other repertoire. Certain similarities between the transcribed ornaments in Figure 3 suggest procedural knowledge (see Bangert et al., 2014) that is difficult to articulate verbally and results from HIP experience. For instance, E1b’s arpeggiation in the third bar of Figure 3 is similar to Schröder, and their use of passing notes is comparable to Ringborg.

### Deliberate decision-making

Examples of deliberate decisions illustrate the musical features of concern to participants while practising. For example, although the vast majority of decisions about note duration were made intuitively, two participants made deliberate decisions about the length of the low A flat in two identical bars: bars 6 and 63 (see Figure 4).



Figure 4. Grave from *Assaggio in C minor* BeRI 310, bars 63-64.

All seven participants decided to shorten the A flat to a quaver or less and since it is not possible for technical reasons to hold it for the full minim specified, it could be argued that no decision was necessary. Nevertheless, Participants E2b and E3a both provided evidence of their deliberations in their concurrent verbal protocols while practising. Participant E2b used a four-step trial-and-error process to come to a decision, articulated as follows:

1. Okay, so definite slow started trill on F sharp final cadence but you want to have that A flat sustained underneath it to give it a really rich, full kind of solid sound [plays bars 63-64].
2. I kind of hit the dissonance on that penultimate note but maybe more rely on an acoustic space, rely on the room to infer that [plays bars 63-64].
3. That’s not going to happen so it seems unless I voice the A flat again I lose that double stop on the second last note [plays bars 63-64].
4. The trill doesn’t work with the A flat. It’s too harsh a dissonance anyway. It’s too cheesy, too cheesy so we have to let the A flat go.

Participant E3a, by contrast, came to a decision more swiftly:

So first question mark there of length—to hold on in bar 6—and I also need to think whether or not I am meant to somehow sustain the A flat. There’s no other way I can see of doing it immediately so I guess it’s not meant to be held on.

Another example of a complex issue requiring deliberate decision-making was chord playing, for which 67% of decisions were made deliberately (see Table 2). One instance occurred in bars 48-52 where quadruple stops are notated. Several historical sources discuss methods of chord playing, including Rameau’s preface to his *Pièces de clavecin en concerts*:

At places where one cannot easily perform two or more notes together, either one arpeggiates them, stopping on that [note] from the side of which the melody continues; or one gives the preference, sometimes to the notes at the top, sometimes those at the bottom (Rameau, 1741, cited by Donington, 1977, pp. 59-60).

Bengtsson and Frydén (1958/1976, p. xxv) suggest three solutions to performing bars 48-52 in their edition of the piece, shown in Figure 5A, B, and C. These were not used by any of the participants; rather, they played arpeggios as shown in Figure 5D. This solution can also be heard in the recordings of Jaap Schröder and Peter Csaba. It is relatively easy to execute and avoids the need for double-stopping or switching to sextuplets.

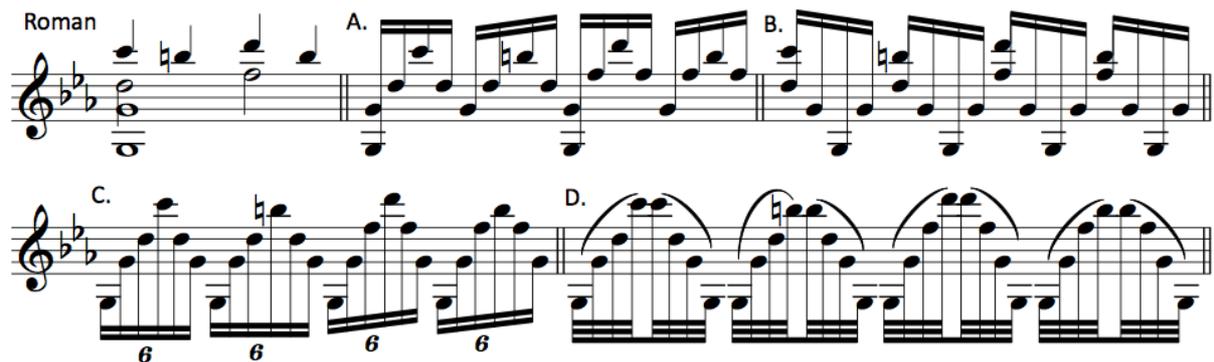


Figure 5. Grave from *Assaggio in C minor* BeRI 310, bar 48.

As can be seen in the shaded areas of Figure 6, all but two participants arpeggiated chords while performing bars 42 to 60, and one (Participant E3b) arpeggiated throughout this section.

Bar	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
E1a							■	■	■	■	■	■							
E1b															■	■	■	■	
E2a																			
E2b													■	■	■	■	■	■	
E3a							■	■	■	■	■	■							
E3b	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
E3c																			■

Figure 6. Arpeggiated chords while performing (bars 42-60).

The participants who did not arpeggiate (E2a and E3c) chose instead to play quickly rolled quadruple stops, sustained double stops, or legato melodic lines. Participants E1a and E3a decided to arpeggiate only from bars 48 to 53 when both sight-reading and performing, a decision discussed in their retrospective verbal protocols after sight-reading:

E1a: The other thing, I got to bar 43 and I started thinking “mmm maybe this should be arpeggiated” but I thought, “ah, at this stage there’s a lot of movement happening still with the little semiquavers and crotchet movements so I thought I’d just keep it.” But I’m pretty sure that already in 43 I was thinking “maybe I should be doing [sings arpeggios]” then and that became even more of a thought down in 48.

E3a: Here [bar 48] I thought “maybe it is meant to be arpeggiated, I’ll just try that out for a minute and see how that sounds.”

As shown in Figure 7, bars 54-57 require the performer to play a two-bar sequence twice, notated as one broken and seven unbroken chords. Ringborg's recording uses the solution recommended by Bengtsson and Frydén (1958/1976, p. xxiv) for all four bars (Fig. 7A repeated), while Schröder and Csaba use it only in bars 54-55, followed by the alternative shown in bars 56-57 (Fig. 7A then B).

**Figure 7.** Grave from *Assaggio in C minor* BeRI 310, bars 54-57.

Participants E1a and E1b made contrasting decisions about this passage while practising, as illustrated in their concurrent verbal protocols. Participant E1a decided not to arpeggiate:

In bar 55 you have the daggers over the notes, which shows me that those chords are evenly placed, not split. I don't know, I guess that's where intuition comes in. I hope it's correct intuition.

Participant E1b chose Bengtsson and Frydén's solution (Fig. 7A), maintaining the rhythm of the first chord for the first two bars only:

The notation in 54 (hums). Yes, that's the order in which the notes are played; probably the priority of length given to them but it should be a very loose interpretation. It's just a spread chord.

The examples discussed demonstrate that most participants relied on intuition and only occasionally provided explicit deliberation during practice. This may be attributable, however, to the length and technical difficulty of the piece.

## CONCLUSION

The purpose of the present study was to observe and distinguish between intuitive and deliberate decision-making processes used by a group of Baroque violinists when interpreting an unfamiliar piece of solo Baroque violin music. While participants were not familiar with the piece, their HIP experience clearly influenced their interpretations, as shown by Participant E1a's comment:

You have to try things and then think, "okay they don't work due to style." I made a couple of comments that I'm hoping are correct. That it's not Italian, that it's not French, it's more Germanic, which is just from my experience of playing other repertoire. I couldn't see comparisons with other composers... I think I recognise other things. I haven't played it, I haven't heard it before but it certainly reminds me of other things.

First, participants sight-read the piece, requiring them to make rapid, intuitive decisions as to how to play it. This was confirmed by Participant E3a, for example, who reported “just playing on instinct.” Second, participants were given up to 45 minutes to practise the piece, marking the score as they did so and providing a concurrent verbal protocol representing their thought processes. Deliberate decision-making was inferred from the score markings and verbal data. Finally, participants gave a performance of the piece informed by decisions of both types. In line with Evans (2011), decisions were categorised as intuitive in the absence of score markings or verbal comment during practice. On the whole, the final performance task was described as “more intentional” (Participant E2b) than sight-reading; as Participant E3b commented, “I was concerned about all the things I practised.”

For the most part, participants made decisions about basic features of the music, such as bowing. Their focus on technical matters may reflect the requirement to perform an unfamiliar piece after a relatively short practice period, the specific challenges of the piece, as well as the limitations of the coding process.

The number of decisions made by participants varied between the three levels of expertise (E1, E2 and E3); more experienced participants made a significantly greater number of decisions than less experienced participants. As a single group, participants made approximately 82% of all decisions intuitively. As individuals, they made, on average, 83.5% of all decisions intuitively, but the most experienced performers (Participants E1a and E1b) made larger proportions of deliberate decisions.

Most performance decisions regarding articulation, bowing, phrasing, note duration, ornamentation and tempo were intuitive, while most regarding dynamics and chord playing were deliberate. A subset of deliberate decisions consisted of those that were made while practising but not executed in performance, including 52% of all decisions regarding dynamics. Although note durations were consistent between sight-reading and performing, most decisions made while performing were different from those made while sight-reading.

Several limitations of the study should be considered when determining the extent to which these results can be generalised. The small sample size was the result of recruiting musicians with specialist training, and replication with a larger sample would enable further exploration of potential differences between groups of participants with varying levels of expertise. In addition, the effects of musical complexity and familiarity on the number and type of decisions made by participants could be investigated in future studies through the use of multiple pieces. Another limitation was the subjectivity of the coding process, which could be validated to a greater degree in future research through cross-checking by several researchers at each stage of data preparation and analysis. However, the fact that the same researcher (first author) annotated all the participants’ performances ensured that the process was consistent. Furthermore, because he has a dual background in Baroque violin performance and musicology, the process was reliable: close listening and observation of performance attributes in relation to the score are tasks that are regularly undertaken by musicologists with (as in the present study) or without the use of technology for repeated listening to short segments or to slow the tempo to hear finer details. The final limitation to be considered is the ability of participants not only to undertake the musical tasks of sight-reading, practising and performing, but also to provide retrospective and concurrent verbal protocols. Participant E2a, for example, provided a much shorter concurrent protocol while practising than other participants and claimed, “I’m not great with words.”

In summary, processes of musical decision-making that have received little attention in the literature on music performance, apart from broad distinctions (e.g., Clarke, 2005; Thompson, 2009), were observed and categorised in the present study. Its findings support the default-interventionist view of dual processes (Evans, 2011) and its theoretical framework and novel methods of implicit categorisation may inform and assist the design of future research in this area. While it has been suggested that historically informed performance involves making deliberate choices about musical style and expression (Haynes, 2010), we have shown that, at least for some period instrument performers, intuitive processes are as, if not more, important when first learning a piece. Nevertheless, the most experienced participants in the present study made more decisions and a greater proportion of deliberate decisions. This finding may be attributable to superior expertise in relation to technique generally, Baroque style and/or practising strategies.

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# Article

## Appendix A: Grave from Assaggio in C minor BeRI 310 by J. H. Roman

Score based on Roman's autograph manuscript MAB: Ro no. 61, a copy by Roman's pupil and successor at the Royal Orchestra Per Brant MAB: Ro no. 60, an edition by Ingmar Bengtsson and Lars Frydén published by Almqvist & Wiksell in 1958, and an edition by Johan Tufvesson published online in 1999.

**Grave**

31

35

38

41

45

48

51

55

59

62

Detailed description: This block contains the musical score for the first system of 'Grave'. It consists of ten staves of music. The first staff is the treble clef with a common time signature. The second staff has a '3' above it, indicating a triplet. The third staff has a '6' above it, indicating a sextuplet. The fourth staff has a '3/4' time signature. The fifth staff has a '41' above it. The sixth staff has a '45' above it. The seventh staff has a '48' above it. The eighth staff has a '51' above it. The ninth staff has a '55' above it. The tenth staff has a '59' above it. The eleventh staff has a '62' above it. The score is in C minor and features various rhythmic patterns and dynamics.

Detailed description: This block contains the musical score for the second system of 'Grave'. It consists of ten staves of music. The first staff is the treble clef with a common time signature. The second staff has a '31' above it. The third staff has a '35' above it. The fourth staff has a '38' above it. The fifth staff has a '41' above it. The sixth staff has a '45' above it. The seventh staff has a '48' above it. The eighth staff has a '51' above it. The ninth staff has a '55' above it. The tenth staff has a '59' above it. The eleventh staff has a '62' above it. The score is in C minor and features various rhythmic patterns and dynamics.