In search of reflection-in-action: An exploratory study of the interactive reflection of four experienced teachers

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HIGHLIGHTS

- Analyses the interactive reflection of four experienced teachers to empirically examine Schön's reflection-in-action.
- Video stimulated recall is triangulated with non-participant observation, audio-diaries and delayed interviews.
- Provides support for Schön's reflection-in-action but also for other reflective processes not discussed by Schön.
- Eight category typology of teacher interactive thought and taxonomy of interactive reflection are proposed.
- Three types and six patterns of interactive reflection emerge from inductive coding and analysis.

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ABSTRACT

Despite widespread discussion of Schön's reflection-in-action in teacher education literature, few studies have attempted to document it during interactive teaching. Those that do invariably fail to separate it from post-hoc reflection on action. This study uses triangulated video stimulated recall to investigate the interactive reflection of four experienced teachers of English as a foreign language. It provides evidence to support Schön's construct of reflection-in-action, but also documents reflective processes not mentioned by Schön. An empirically-derived eight category typology of teacher interactive thought and taxonomy of interactive reflection are proposed along with three types and six patterns of interactive reflection.

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1. Introduction

Donald Schön's writings on reflective practice have exerted a far-reaching influence on the field of practitioner learning, including teacher education, despite the fact that Schön made little reference to classroom teaching in his work (1983, 1987, 1992, 1995). Perhaps the most influential constructs that Schön developed are those of reflection-in-action (RiA) and reflection on action (RoA), often understood in teaching to describe reflection during (RiA) and after (RoA) the teaching act (e.g., Moallem, 1998; van Manen, 1995). While reflection on past practice is widely promoted in contemporary teacher education (e.g., Brookfield, 2017; Farrell, 2015), the questions of whether, and how we reflect while teaching, as well as the related question of what impact such reflection has on teacher learning have been the subject of significant debate, including criticism directed towards Schön's concept of RiA (e.g., Eraut, 1995; van Manen, 1995), and his epistemology of practice (e.g., Fenstermacher, 1988; Gilroy, 1993).

Despite this theoretical debate, and frequent references to RiA in the literature on teacher education, few empirical studies of teacher RiA in real classroom contexts exist, and many that have attempted to document it fail to separate the interactive reflection of RiA from the post-hoc reflection of RoA (Borg, 2006; Yinger, 1986). With this challenge in mind, this study investigates interactive reflection in general, and Schön's concept of RiA more specifically, using triangulated video stimulated recall (VSR) to examine the interactive thought processes of four experienced teachers of English as a foreign language (EFL) in their classrooms. The findings include a novel typology of teacher interactive thought, extensive evidence of interactive reflection, and a number of terms and constructs for analysing interactive reflection which may be of use to researchers

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interested in studying teacher cognition, and to both teacher educators and teachers interested in developing their understanding of interactive thought and its relationship to teacher learning, self-awareness and reflection literacy. While language teaching provides the context for this study, the findings are presented as potentially useful to teachers working in a range of classroom types.

1.1. Key definitions

Affordance: The term "affordance" is used below to indicate an emerging situation (e.g., an opportunity or problem) within the teaching process. Affordances are unplanned; teachers may choose to respond to or ignore them during the teaching act (Anderson, 2015).

Interactive: The term "interactive" is used below to mean during the lesson, following Jackson's distinction (1968/1990) between interactive and preactive aspects of teaching.

Reflection: A distinction is made here between "critical reflection" and "practical reflection". The term critical reflection is used below to refer to careful deliberation of one's practice and/or beliefs. Discussion in the literature suggests that such reflection leads to learning through new understandings, greater insight, and/or greater responsibility for future action (e.g., Dewey, 1910; Fendler, 2003; Zeichner, 1981). Practical reflection is used to refer to more spontaneous, rapid thinking about one's practice that is still nonetheless explicit (Eraut, 1995; van Manen, 1991). A continuum between these two may be envisaged (Eraut, 1995) along which variables such as duration, carefulness and criticality vary (see Fig. 1). Both are inevitably informed by experience, although the possibility of critical reflection also being directly informed by theoretical, received knowledge (Dewey, 1910) is also recognised here. While the importance of critical reflection for practitioner learning is widely acknowledged (e.g., Brookfield, 2017; Farrell, 2015), the role of practical reflection in learning is less clear, and contested, particularly with regard to Schön's RiA, discussed below.

2. Theoretical framework and literature review

2.1. Reflection-in-action

Reflection-in-action plays an essential role in Schön's epistemology of practice (his theory of practitioner learning), without which it cannot be fully understood (1983). Within this epistemology, Schön describes "knowing-in-action" ("knowing-in-practice" for professionals) as the instinctual, procedural knowledge that practitioners develop through practice (1983, 1987), informing the majority of our automated decision-making. RiA constitutes a means for developing this knowing-in-action (practitioner learning) through a process of awareness raising leading to restructuring without the need for the received knowledge of academia that Schön called "technical rationality" and was highly critical of (1983). He defines RiA as follows:
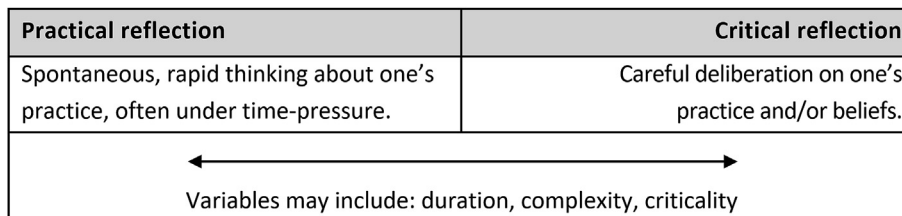
Reflection-in-action … is central to the art through which practitioners sometimes cope with the troublesome "divergent" situations of practice. When the phenomenon at hand eludes the original categories of knowledge-in-practice, presenting itself as unique or unstable, the practitioner may surface and criticise his initial understanding of the phenomenon, construct a new description of it, and test the new description by an on-the-spot experiment. (1983, pp. 62-3).

Here and elsewhere (e.g., 1987, 1995) Schön describes RiA as a process, initiated by a puzzle or surprise, which leads to the "surfacing" and explicit awareness of one's procedural knowledge (KiA). This undergoes restructuring as a result, implying a type of critical reflection, as defined above. However, Schön also at times discusses a more instinctual side to RiA, for example, in the improvisation of jazz musicians:

They are reflecting-in-action on the music they are collectively making and on their individual contributions to it, thinking what they are doing and, in the process, evolving their way of doing it. Of course, we need not suppose that they reflect-in-action in the medium of words. More likely, they reflect through a "feel for the music" which is not unlike the pitcher's "feel for the ball." (1983, p. 56).

This description of a more instinctual type of reflection appears shortly after Schön's first mention of RiA (1983, p. 54), when he also refers to "thinking on your feet", leading many to presume that this is all Schön meant by RiA—an adaptive response to a situation at hand (e.g., Mann & Walsh, 2017). It is important to acknowledge this potential variation in Schön's descriptions of RiA, so both types will be considered below as potential vehicles for practitioner learning. The first type will be referred to henceforth as *critical reflection-in-action* (CRiA) and the second as *adaptive reflection-in-action* (ARiA). Importantly, rather than seeing them as separate, Schön often invokes both understandings in his writings in close association (1983, 1987), also frequently linking them to knowing-in-action: "The distinction between reflection- and knowing-in-action may be subtle" (1987, p. 29). Schön here implies a continuum of sorts, with knowing-in-action at one end and RiA at the other, potentially mirroring the reflective continuum above. However, while obvious links can be made between critical reflection and Schön's CRiA, the relationship between practical reflection (as defined above), Schön's knowing-in-action (automatic), and ARiA (potentially partially explicit) is less clear, and discussion of this follows, and draws upon, the findings presented below.

A number of theories in cognitive psychology could be used to support Schön's epistemology of practice. While dual-process theories (e.g., Evans & Over, 1996; Stanovich & West, 2000) recognise both instinctual (System 1) and more deliberate, even "reflective" (Carruthers, 2014, p. 181) processes (System 2), they see the systems as distinct (Barrouillet, 2011; Osman, 2004), rather than continuous, as Schön implies. An alternative, single-system

Practical reflection	Critical reflection
Spontaneous, rapid thinking about one's practice, often under time-pressure.	Careful deliberation on one's practice and/or beliefs.
Variables may include: duration, complexity, criticality	

Fig. 1. Continuum of practitioner reflection.

theory, potentially more compatible with Schön's, is Cleeremans and Jiménez's (2002) Dynamic Graded Continuum (DGC), which aims to offer a description of "the relationship between learning and consciousness" (p. 14). The DGC posits a cline from implicit (weak) to explicit to automatic representations as strength, distinctiveness and stability increase, recognising that explicit representations can become automatic through practice. It sees both explicit and automatic representations as being available to conscious awareness, although the latter "can no longer be controlled" (p. 24). From a DGC perspective, knowing-in-action involves learnt automatic representations, and RiA is the process by which these are brought into "explicit cognition", possibly with CRiA involving more explicit awareness than ARiA.

2.2. "Reflection-in-action" and "reflection on action"

A further important question, particularly for teaching, concerns what exactly Schön meant by the "in" in "reflection-in-action". He notes (1983; 1987; 1995) that for reflection to be "in-action", it must happen during the "action-present": "a stretch of time within which it is still possible to make a difference to the outcomes of action" (1995, p. 30). While this could potentially refer to longer time periods, such as courses of learning, this paper assumes that "in" means "during the lesson" (Farrell, 2018; Moallem, 1998). Thus, both CRiA and ARiA will be discussed as interactive reflection below.

Interestingly, Schön rarely discusses (and never hyphenates) "reflection on action" (1983, 1987, 1992, 1995), despite the equal weight often afforded it in the literature. He appears to have only defined it once, as "thinking back on what we have done in order to discover how our knowing-in-action may have contributed to an unexpected outcome" (1987, p. 26). He also sometimes refers to "reflection on reflection-in-action" (RoRiA), a simultaneously explicit recall *of* interactive thinking combined with reflection *on* that interactive thinking (1995).

2.3. Theoretical criticism of Schön's epistemology

Criticism of Schön's epistemology of practice includes Fenstermacher's (1988) critique of Schön's (mis)use of terms such as epistemology and research, and Gilroy's (1993) more philosophically oriented response. Eraut's (1995) more practically-directed critique notes that RiA is inconsistently defined by Schön and of little relevance to teachers who may not have time to reflect-in-action while teaching (also noted by van Manen, 1995). He observes that Schön's discussion of RiA rarely considers educational contexts, and when it does, it focuses on tutoring, rather than "crowded settings like classrooms" (p. 9), ultimately questioning whether RiA has any significant role in classroom teaching at all.

2.4. An alternative model of interactive thinking

Prior to the reflective turn of the 1980s, early research into teacher interactive thinking focused primarily on decision-making processes (e.g., Calderhead, 1979; Peterson & Clark, 1978; Snow, 1972), and the antecedents of such decisions, including Marland's then-influential VSR research (1977, 1986; also see Conners, 1978; Warner, 1987; Wodlinger, 1980). Marland developed a taxonomy of "thought units", involving "the application of a cognitive process to a referent, either concrete or abstract" (1986, p. 213; see Table 1). His taxonomy constituted an important early attempt to study interactive thinking empirically, although his category "reflection" referred only to "units in which the teacher is thinking about past aspects of lessons" (1977, p. 83), and neither his, nor the subsequent studies in this vein, discussed the role that interactive thinking might play in teacher learning as Schön's concept of RiA implies.

This line of research soon came under criticism (e.g., Parker, 1987; Shulman, 1986; Yinger, 1986), and began to decline, just as research into teacher reflection was increasing as a separate line of enquiry. Little cross-referencing occurred between the two, even within the work of a single author (compare, e.g., Calderhead, 1984, and 1989; or Johnson, 1992, and 1994), probably because they were often paradigmatically and methodologically separated during the so-called "paradigm wars" (Gage, 1989) of the era. Interactive thinking was often studied using more post-positivist, quantitative research designs, and reflection in more constructivist, qualitative studies. As a result, the potential value of Marland's taxonomy for investigating RiA was overlooked.

2.5. Research into reflection-in-action

Reflection-in-action has been the focus of a comparatively small number of (mainly qualitative) studies since the late 1980s. Several have (somewhat creatively) interpreted reflective learning that occurs between lessons as RiA (e.g., Burhan-Horasanlı & Ortaçtepe, 2016; MacKinnon & Erickson, 1988). Others have attempted to use interviews to shed light onto interactive processes, typically eliciting justifications for decisions (more likely to elicit RoA than RiA) and failing to link this to classroom data (e.g., Bartelheim & Evans, 1993; Ferry & Ross-Gordon, 1998). For example, Munby and Russell's extensive research on teacher reflection included one paper (1989) that claimed to document RiA (pp. 76–79) through such interviews. However, by encouraging teachers to reflect *on* their general practice, they elicited RoA, and provided no evidence of direct recall of RiA.

While VSR offers a potentially useful tool for documenting and

Table 1
Marland's taxonomy of thought units.

Unit	Description
Perception	Unit in which teacher reports a sensory experience
Interpretation	Unit in which teacher attaches subjective meaning to perception
Prospective tactical deliberation	Unit in which teacher reports thinking about a tactic to be used later in the lesson
Retrospective tactical deliberation	Unit in which teacher contemplates tactic or course of action already used in the lesson
Reflection	Unit in which teacher ponders past aspect of, event in, lesson other than tactic
Anticipation	Speculation or prediction about what could, or is likely to, occur later in the lesson
Information-pupil	Unit in which teacher's thinking is centred on prelesson knowledge of pupil(s)
Information-other	Unit in which teacher's thinking is focused on other information brought to the lesson (e.g., plan, school policy, theory, subject matter)
Goal statement	Unit in which teacher is thinking about intended pupil outcomes
Fantasy	Unit in which teacher expresses fanciful, bizarre comment
Feeling	Unit in which teacher reports an affective state personally experienced during instruction

Note. Adapted from Marland, 1986, p. 225.

eliciting recall of RiA, most studies that have made use of it either did so to investigate RoA (e.g., Muir, Beswick, & Williamson, 2010), or involved research designs that did not allow researchers to separate RiA from RoA (e.g., Gün, 2014; MacKinnon, 1987; Martinelle, 2017; Roe, 1990), a challenge that Yinger (1986) highlighted. Gün (2014), for example, asked teachers to both recollect and "explain their interactive decisions" (p. 80), thus leaving no way of separating post-hoc RoA from recalled RiA.

Two studies have had more success in documenting RiA. Moallem (1993, 1994) used VSR to investigate mainly RoA, although she also discusses a small amount of data involving recall of interactive problem-solving strategies (pp. 182–188), that sheds some light onto the teacher's RiA, noting particularly the importance of evaluation during RiA. Shroyer's (1981) innovative study of "critical moments" in teachers' interactive thinking predated Schön's first writings on RiA. Despite this, it frequently documents processes indicative of Schön's CRiA, as in the following recall of an unresolved puzzle from one teacher:

> I thought it shouldn't be causing them that many problems! Maybe there is something else. Maybe I am going too fast for them. But I didn't think I really was going fast at all! I am sort of puzzled! (p. 141).

Thus, while there have been a number of attempts to document RiA, few have drawn upon systematically collected data originating in classroom practice. Those that have, have often failed to distinguish RiA from RoA, and have almost exclusively focused on "instructional shifts" (changes in the lesson pace, method or materials; Bartelheim & Evans, 1993), which is problematic because RiA may not be prompted only (or even mainly) at such moments. Even Shroyer's study limits data collection to moments of teacher discomfort, yet reflection may happen at any point during a lesson. It is possible that the most formative reflective moments occur at the least challenging points in the lesson, for example, during "stop and think" pauses (Arendt, 1971). This lack of empirical research into RiA provides justification for the present study.

3. Methodology

3.1. Research questions

Four research questions were investigated using video stimulated recall as the main data collection method, triangulated with other methods including non-participant observation, audio diaries and delayed interviews:

1 What broad categories of thought process can be identified during the interactive teaching of experienced teachers?
2 To what extent can the thought process categories identified and the individual examples of these be classified as "reflective thought"?
3 What evidence is there that some, or any, of these types of thought constitute what Schön would have called "reflection-in-action"?

4 What else can we learn about teacher interactive reflection from this study?

The study was designed with careful consideration of the potential challenges associated with using VSR to study teachers' thought processes (Gass & Mackey, 2017; Yinger, 1986), particularly the danger that, rather than recalling interactive thinking, VSR may elicit "post-hoc rationalisation" (Borg, 2006, p. 211; Yinger, 1986). Factors that may elicit this include the interviewer's recall prompts (Borg, 2006; Gatbonton, 1999), the posing of leading questions (Gass & Mackey, 2017; Yinger, 1986), the video stimulus itself (Yinger, 1986), the pressure to recall (Borg, 2006), and memory loss before delayed VSR (Gatbonton, 1999).

3.2. Participants

Four experienced English as a foreign language (EFL) teachers were recruited for the study, from two private schools for adult learners in the UK (see Table 2). Choice of participants was informed by several factors:

1. relevant experience (minimum four years) and qualification level (UK RQF level 7)
2. interest and availability to participate in the study
3. opportunity for VSR immediately after lessons
4. opportunity for a variety of class types to be involved

The range of levels, class types and the small class sizes involved are fairly typical of adult EFL in the UK. Participants were informed that the study aimed to investigate their interactive thinking, but not that my focus was specifically reflection.

3.3. Data collection

An initial pilot study was carried out to trial three potential approaches to conducting VSR interviews, and also to provide data for development of an initial coding framework. For the main study, data was collected in each school as per Table 3. Ethical consent was provided by all participants.

VSR data collection: Following initial "acclimatisation observations", during which teachers and students gained familiarity with my presence in the classroom, two 80–90-min lessons were observed and video recorded per teacher. During observation, classroom sketches and "narrative field notes" (Dörnyei, 2007) were taken, especially on events not captured by the camera. Immediately following each lesson (Ericsson & Simon, 1993), teachers viewed lesson extracts selected to include both a variety of lesson activities (e.g., instructions, individual work, collaborative work, teacher-led clarification, etc.) as well as a number of instructional shifts noted during observation. Table 4 provides the aims of the eight lessons.

The instruction provided before VSR commenced told them *only* to pause the video when they recalled their thoughts at the moment of the lesson being observed, "including things you noticed, things you felt, decision moments, reflections, confusions,

Table 2
Participant and class profiles.

Name (pseudonyms used)	Experience (years)	Observation class type and student proficiency level (CEFR scales used)	No. of learners in classes observed
Robin (male)	9	General English, A1-A2 (elementary)	2–3
Hannah (female)	7	First Certificate in English (exam class), B1-B2 (intermediate)	4
David (male)	7	Legal English (ESP), B2-C1 (intermediate−advanced)	7–8
Amber (female)	4	Cambridge Advanced English (exam class), B2-C1 (intermediate−advanced)	6

Note. CEFR: Common European Framework of Reference; ESP: English for specific purposes.

Table 3
Schedule for data collection for each institution.

Preceding weekend	Monday	Tuesday	Wednesday	Thursday	Friday	8−10 days later
Initial interviews. Teachers view example VSR video.	Initial observations, meeting with students, explanation of research project.	Teacher A: observation and video recording of lesson followed by immediate VSR (1).	Teacher B: observation and video recording of lesson followed by immediate VSR (1).	Teacher A: observation and video recording of lesson followed by immediate VSR (2).	Teacher B: observation and video recording of lesson followed by immediate VSR (2).	Delayed interview
	Teachers record audio diary.	Teachers record audio diary.	Teachers record audio diary.	Teachers record audio diary.	Teachers record audio diary.	

Table 4
Aims of the eight lessons.

Teacher	Lesson #	Aims
Robin	1	To introduce and practise lexis, functional language, reading and speaking skills relating to shopping.
	2	To introduce and practise phrasal verbs, listening and pronunciation skills relating to holidays.
Hannah	1	To notice, learn and practise using common items tested in open cloze exam tasks. To evaluate sample exam task writing scripts.
	2	To practise and revise phrasal verb synonyms. To develop speaking skills for picture comparison speaking exam task.
David	1	To learn key concepts and lexis in legal English relating to civil procedure. To practise reading and speaking skills. To revise lexis from previous lessons.
	2	To develop legal reading and writing skills, including appropriate language for formal email exchanges. To revise lexis through communicative game.
Amber	1	To practise evaluating exam writing scripts using rubric. To notice useful language for exam writing task. To plan own writing assignment.
	2	To introduce and practise using a range of conjunctions and discourse markers to improve cohesion in essay writing tasks.

problems, etc.", stressing the importance of not inventing reasons (post-hoc rationalisation; Borg, 2006), or making observations based on what they noticed in the video (Yinger, 1986). Apart from indicating start times for each extract, once VSR began I did not interrupt, eliminating the danger of leading questions or prompts (Gass & Mackey, 2017; Yinger, 1986). Participants had complete control of playback, enabling them to focus on their thoughts, and reducing the risk of feeling pressure to comment (Borg, 2006). Afterwards, a "post-VSR interview" was conducted, in which teachers were invited to reflect on the VSR process itself.

Supplementary data collection: Initial interviews (55−70 min) were recorded to collect background information about courses, learners and participants' espoused beliefs about teaching and learning, which also helped to build rapport. Useful documentation, such as lesson plans for the week, coursebook details and other course materials were also collected. Teachers were asked to record 15−20-min audio diaries after teaching each day to reflect on two questions: "How did the lesson go today?" "What are you going to do tomorrow?" Just over a week after data collection, delayed interviews were conducted (30−45 min) to investigate how salient selected events from teachers' VSR recalls and audio diaries remained.

3.4. Data analysis

VSR interviews and associated lesson segments were transcribed in full in tabular format, with notes added on paralinguistic features. Each recall, defined here as the spoken data provided during one pause of video playback, constituted one row. Transcriptions were coded for thought types, using (but further developing) the inductive framework from the pilot study (Miles & Huberman, 1994) and creating a protocol for code assignment during the process (see Supplementary Data: Appendix A: Examples of transcribed VSR data, and Appendix B: Protocol for assigning codes). Iterative coding cycles were conducted until categories stabilised (five iterations), indicating "saturation" (Dörnyei, 2007, p. 244). While I was aware of Marland's (1977) categories, I chose not to use them as a guide.

Inter-rater reliability tests of the coding framework were carried out, involving three PhD students who, after 80 min of training, coded randomly-selected sections of data for the main thought categories only. Analysis followed tabulation guidelines by Fleiss (1981). "Substantial agreement" (Landis & Koch, 1977) was found using Cohen's K; $K = 0.630$ (95% CI, 0.510 to 0.750), $p = < .0001$, between theirs and my original codings. Two raters agreed much more closely than the third (see Table 5), indicating that more training would have been useful (Marland's raters required 10 h of training to achieve scores of 0.70; 1977).

Descriptively coded data was analysed both quantitatively and qualitatively. Quantitative analysis involved comparing frequencies of different thought categories and subcategories between teachers and overall frequency of subcategories. Qualitative analysis involved two stages beginning during the process of descriptive coding (Miles & Huberman, 1994). As I became familiar with both content (what was being said) and expression (how it was being said) of recalls, associations between the eight thought categories and different types of reflection discussed above began to emerge, leading to the identification of several broad types of interactive reflection. During the second stage of analysis, contextualised, supra-segmental analysis of transcripts identified "pattern codes" (Miles & Huberman, 1994, p. 57), discussed as "patterns of interactive reflection" below. Finally, illustrative "vignettes" (Dörnyei, 2007, p. 255) to exemplify both types and patterns of interactive reflection were selected for presentation.

Supplementary data was also transcribed and coded thematically to facilitate triangulation and qualitative understanding of VSR data, although no inter-rater analysis was conducted on this data.

Data is transcribed below to preserve a number of important features for interpretation, including false starts, fillers ("um", "er"), vocalisations and paralinguistic features (in square brackets), striking a balance between "readability and accuracy" (Bailey, 2008). "(.)" indicates pauses of over 1 s, and "[x]" indicates unintelligible utterances. Selective omissions are indicated by ellipses (…). All names are pseudonyms.

Table 5
Summary of Inter-rater reliability tests.

Rater	# codings	Cohen's Kappa	Standard Error	Significance	Confidence interval
A	38	.674	.085	<.0001	0.507−0.840
B	17	.649	.128	<.0001	0.398−0.900
C	21	.503	.115	<.0001	0.278−0.728
All raters	76	.630	.061	<.0001	0.510−0.750

4. Findings

4.1. Critical evaluation of VSR data

Given the criticisms levelled at the use of VSR for studying interactive thought (Borg, 2006; Yinger, 1986), this section begins by critically evaluating the degree to which data collected constitutes RiA, rather than post-hoc RoA.

Evidence that the teachers' interactive thoughts were fresh in their minds comes from a number of instances when a recall describes a thought corroborated by a subsequent action in the lesson ($n = 24$). For example, Robin makes the following recall during VSR:

Robin L1/59: This is the moment where I'm thinking, OK Didem has continued to talk about it, Caroline is interested, maybe I should board it up.

Shortly after restarting playback, in the lesson video, the teacher stands and "boards" the relevant language, corroborating the recall.

Evidence that teachers were attempting to recall interactive thoughts is present in numerous linguistic clues, including the frequent use of both present (e.g., "I'm thinking …" [$n = 290$]) and past tense (e.g., "I thought …" [$n = 224$]) introductory clauses, as recommended in the instruction rubric.

Evidence that teachers felt they had succeeded in accessing their interactive thinking comes from the post-VSR interview. Three commented on it being relatively easy:

David: I was quite able to um, to get back into my thought processes um from all the segments that we looked at and I found it quite easy to do that.

The fourth (Amber) indicated that she had greater difficulty, especially for her first lesson. However, the fact that she produced significantly fewer recalls than the others (reasons for this are discussed below), especially when observing this first lesson, suggests that she did not feel pressured to comment when she could not remember.

There were, nonetheless, instances when data has not been coded due to concerns that it was either noninteractive thought ($n = 7$), or observations of the video playback ($n = 12$). Further, I remained aware of the possibility that initial recalls of interactive thought may lead to reflection on the recall itself (Schön's RoRiA), which may have occurred during some of the longer, more reflexive recalls documented below, and is discussed as such.

4.2. The coding framework

Table 6 presents the final coding framework, alongside Marland's (1977). While the primary aim was to identify only broad categories of interactive thought (see research questions), sub-categories emerged naturally, primarily as an aid to categorisation, although these also allowed for description of thoughts at a finer level (see Appendix A in Supplementary Data for examples).

While categories 1−4 corresponded well to Marland's, my focus on reflective processes during coding led to two rather different coding categories to his: *affordance awareness* and *uncertainty awareness* (see Table 6 for descriptions). *Affordance awareness* especially seemed to relate closely to moments when teachers were involved in Schön's ARiA; fielding learner questions, seizing useful opportunities, replanning or anticipating affordance.

During analysis of *value judgements* in the data, a number of more critical reflective thoughts were noticed, and labelled *reflexivity*. During such episodes, teacher's thoughts tended to turn back on their own practices in ways that seemed to be indicative of potential restructuring of knowledge or beliefs (recalling Schön's CRiA). *Reflexivity* seems to begin when evaluations, particularly of own actions (7b) become more extensive, focused, or critical.

4.3. Quantitative analysis

A total of 5 h, 17 min of VSR data was collected. There was considerable variation in the frequency and length of recalls between teachers (Table 7).

Broadly speaking, Hannah and Robin tended to produce shorter, more frequent recalls, while David and Amber produced longer, less frequent recalls (see Appendix A in Supplementary Data). This variation is likely due to differences in lesson type and content, teaching styles and individual personalities. Robin's small elementary class often engaged in quite free ranging discussions of language and content with shorter tasks, extensive teacher-learner interaction and frequent negotiation of meaning resulting from the lower language proficiency of the learners. Hannah's class was also quite small and involved more open interaction and shorter tasks. Both Hannah and Robin also seemed to have naturally talkative personalities, willing to pause the video and interpolate shorter recalls. David's and Amber's classes included more learners (leading to more formalised procedures) and longer tasks appropriate to the more advanced courses they were teaching. As noted above, Amber's first lesson involved extensive individual reading and writing tasks during which she found it difficult to place recalls with certainty. David and Amber were also more cautious when offering recalls, preferring to remain silent, hedge or even retract comments when they weren't sure:

Amber L1/R22: I (.) [hand to forehead] feel like I remember that at that point (.) no I don't remember.

Analysis of coded utterances revealed a somewhat different pattern. Single recalls contained between 0 and 11 coded utterances ($M = 2.5$ codes per recall). Robin's recalls yielded 403 codings, Hannah's and David's 284 and 265 respectively, and Amber's 122. Amber's recalls tended to relay only one or two thought types, albeit often in greater detail.

However, relative frequencies of segments assigned to the eight coding categories revealed greater similarities between the teachers. While *decisions* were comparatively rare, *value judgements* ($M = 21\%$) and *affordance awareness* ($M = 20\%$) were common. *Perception* and *knowledge/memory access* were both fairly common for all teachers, and *reflexivity* constituted 7−10% of coded segments (see Fig. 2).

Despite these overall similarities, there were noticeable

Table 6
The coding framework: A typology of teacher interactive thought.

Category	Subcategories	Description	Marland's equivalent
1 Planned intention	a) immediate (right now) b) future (later in the lesson or course of study) c) getting back on course after affordance	When teacher recalls being aware of an intention linked to her/his plan for the lesson (as opposed to responsive intentions – see 5).	Goal statement
2 Knowledge/memory access	a) of learners (e.g. personalities, likes, strengths, challenges, etc.) b) of prior study/learning (i.e. what they studied before with this class, either in this or previous lessons) c) of subject (i.e. the English language; grammar, lexis, skills) d) of pedagogy (incl. personal beliefs) e) of other (e.g. materials, own life experience, general knowledge, other courses)	When teacher recalls either searching own knowledge/memory, or drawing upon it. (References to difficulty in accessing knowledge should be coded as 7a/b.)	Information; Retrospective tactical deliberation
3 Perception	a) of learners' actions, contributions, moods b) of other factors (e.g. materials, time, boardwork, disturbance, own actions [when these are 'noticed' consciously by the teacher], etc.)	When teacher recalls seeing, hearing, noticing or perceiving something. May include some interpretation (e.g. of ambiguous meaning), but no value judgement in the phrase.	Perception; Interpretation
4 Decision	[none]	When teacher recalls conscious awareness of making a decision.	(Decision[b])
5 Affordance awareness	a) intention in response to learner action or contribution b) awareness of emerging opportunity or problem c) adjustment to prior/planned intention (in relation to affordance) d) anticipation (including expectations and predictions)	When teacher recalls either being aware of an intention in response to something unplanned that came up in the lesson, or anticipating something unplanned.	? (5d: Anticipation)
6 Uncertainty awareness	a) deliberation/questioning b) doubt/confusion/difficulty thinking of something c) hypothesising (i.e. speculating about possible options)	When teacher recalls that s/he was uncertain about something, including deliberations, doubts and difficulty accessing knowledge, but not yet reflexivity.	? (often Prospective tactical deliberation)
7 Value judgement	a) evaluation of learner action, contribution or learner-generated affordance b) evaluation of own action, choice, contribution or response to learner (but without reflexivity) c) evaluation of general progress of lesson (including more instinctual feelings of general satisfaction or concern with progress) d) evaluation of something else (e.g. content, materials, resources)	When the teacher recalls awareness of an evaluative judgment or feeling, including assessment of how an action, activity or lesson stage is going/has gone, but not yet reflexivity.	Feeling; (occasionally Reflection[c])
8 Reflexivity	a) regret of, or annoyance at own practice (not yet 8c) b) self-confirmation (recognition of the positive impact of a decision or action taken during the lesson) c) self-criticism (incl. indication of alternative action) d) awareness of gap in knowledge (pedagogical/content) or own error e) awareness of unresolved puzzle f) questioning/reflecting on prior or general practice	When the comment indicates that teacher examined own practices critically and/or restructured own beliefs.	? (occasionally Reflection[c] or Prospective tactical deliberation)
$ Awareness of observation[a]	[none]	When the comment indicates that the teacher was aware of the observer or video camera.	–

Notes.
[a] Awareness of observation was only required seven times.
[b] Marland (1977) identified decisions from combinations of verbal report and VSR data.
[c] Marland's Reflection "typically involved some sort of evaluation by teachers" (1977, p. 117), but was defined as "units in which the teacher is thinking about past aspects of, or events in, the lesson, other than what he has done" (p. 83).

Table 7
Teachers' differing recall rates.

	Robin	Hannah	David	Amber
Total # recalls	150	141	93	56
# recalls per min. VSR	1.9	2.0	1.0	0.7
# recalls per min. observed lesson	4.8	3.5	2.1	1.0
Average length of recalls	19 s	13 s	31 s	21 s

differences in the relative frequencies of segments assigned to subcategories within each category, especially for categories 2 (*knowledge/memory access*), 5 (*affordance awareness*), 6 (*uncertainty awareness*) and 7 (*value judgements*); see Figs. 3–6. *Reflexivity* is discussed separately below. These differences are likely influenced by course level, type and content as well as teaching styles and personalities. For example, the highly technical language of David's legal English lessons revealed itself in the higher relative frequencies of subcategories 2c (*subject knowledge*), 6b (*doubt/confusion/thinking difficulty*) and 7b (*evaluation of own action, contribution or response to learner*). Hannah's higher relative frequencies of subcategories 2a (*learner knowledge*), 5a (*responsive intention*) and 7a (*evaluation of learner action, contribution or learner-generated affordance*) is consistent with my field notes of "highly learner-sensitive" teaching practices, also evident in her espoused beliefs about teaching and learning from the initial interview:

I tend to be very friendly … rapport's really, really important to me and I like to chat to them and get to know them. I think I'm quite personal.

While these differences between the teachers are interesting, and warrant further research, it should be emphasised that the differences found cannot be presumed to be indicative of differences in the teachers' interactive thinking. Rather, they should be interpreted as differences in their articulated recollections of such thoughts, which, as well as the differences already suggested above, may also be influenced by teaching experience, memory capacity, influence of the research process, differing interpretations of the VSR task, and different ways of expressing themselves.

Analysis of overall frequency of subcategories across the four teachers reveals a further interesting finding with regard to the thought processes that most commonly occupy their conscious awareness while teaching. Fig. 7 displays the ten most frequently recorded subcategories. It is notable that four of the top five involve noticing, responding to, or evaluating learners' actions or contributions, and that only one of the ten (planned intention) relates to the teachers' pre-lesson intentions, providing evidence of experienced teachers' ability to notice and respond to learner contributions, what Yinger (1987) called "improvisational performance", and found to be an important component of the practice of expert teachers in a number of studies (e.g., Borko & Livingston, 1989; Sorensen, 2017; Traianou, 2006). As Borko & Livingston note, "successful improvisational teaching requires that the teacher have
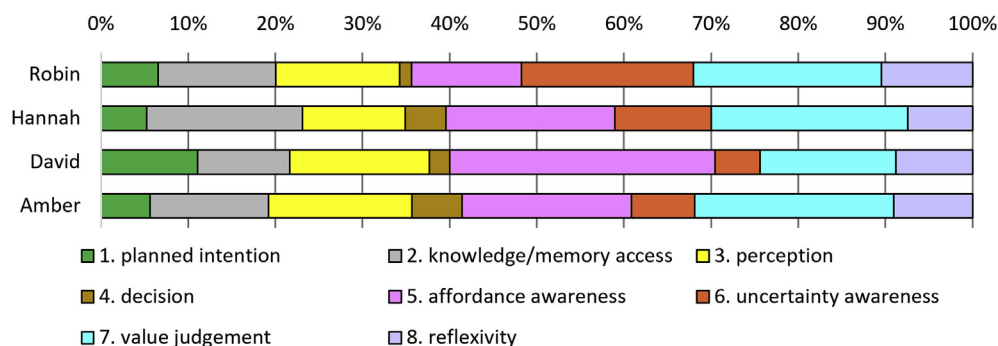
Fig. 2. Relative frequencies of the eight interactive thought categories for the four teachers.
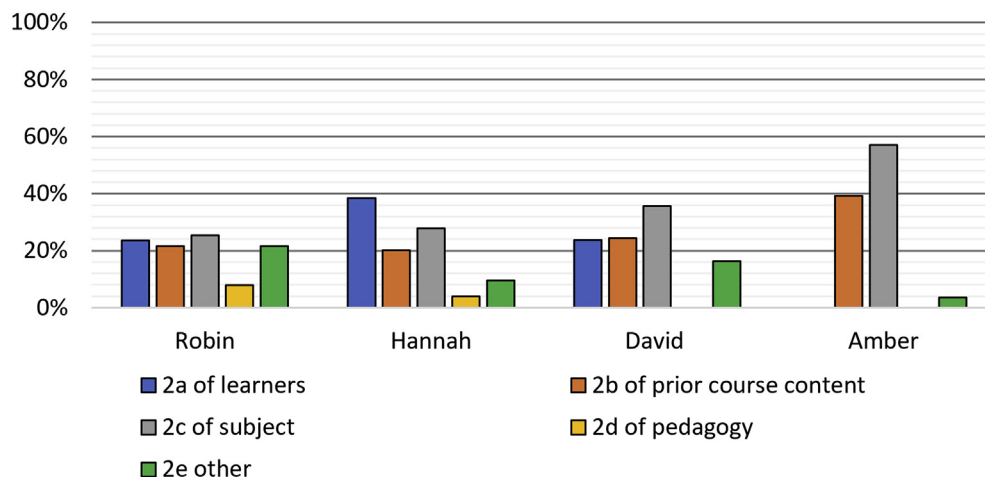
Fig. 3. Relative frequencies of subcategories assigned within thought category 2 (knowledge/memory access) for the four teachers.
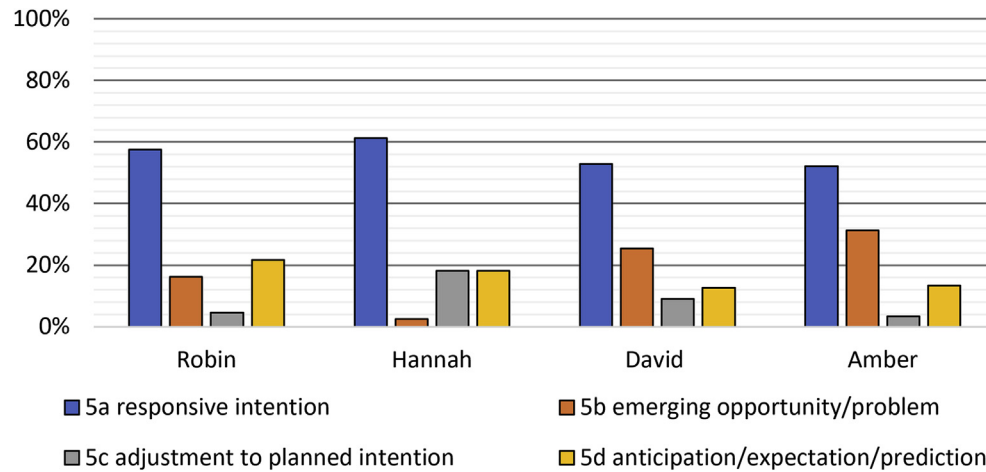
Fig. 4. Relative frequencies of subcategories assigned within thought category 5 (affordance awareness) for the four teachers.
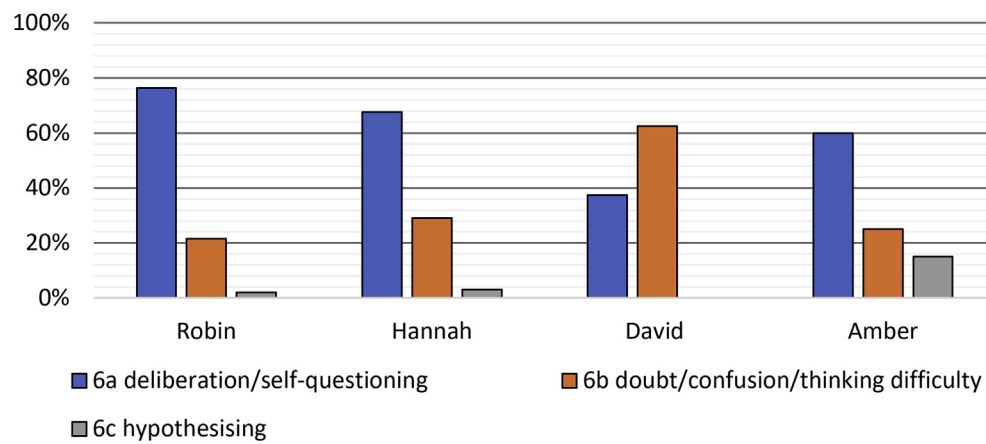

Fig. 5. Relative frequencies of subcategories assigned within thought category 6 (uncertainty awareness) for the four teachers.
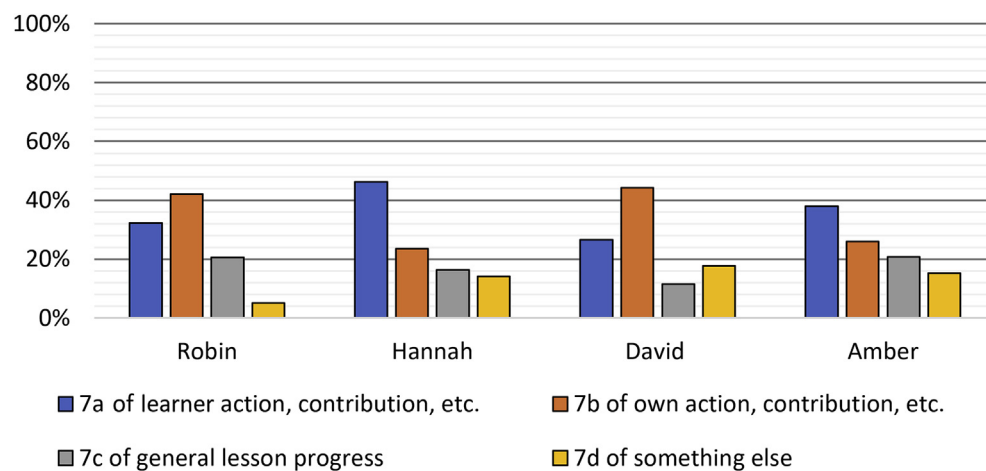

Fig. 6. Relative frequencies of subcategories assigned within thought category 7 (value judgement) for the four teachers.
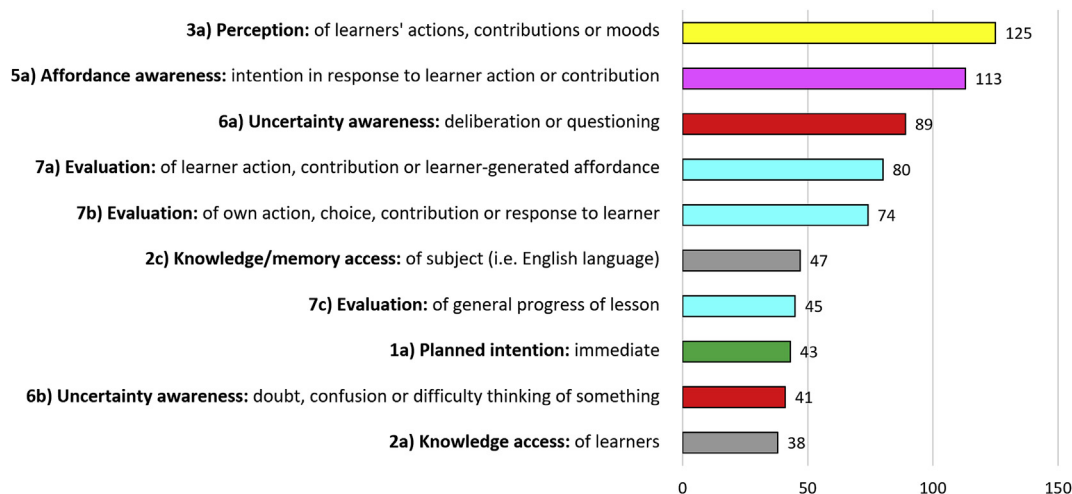
Fig. 7. Most frequent subcategories across all four teachers.

an extensive network of interconnected, easily accessible schemata" (p. 485). While it is not the primary focus of this study, VSR quotes from the four teachers below provide interesting insight into such improvisational performance in action.

4.4. Qualitative analysis: Types of interactive reflection

During data analysis, qualitative differences were found between recall sections coded primarily using categories 1, 2 and 3, those involving categories 5 and 6, and those involving category 8,[1] revealing three broad *types of interactive reflection*, here termed "practical reflection", "adaptive reflection" and "reflexivity".

Recall sections coded predominantly within categories 1 (*planned intention*), 2 (*knowledge/memory access*) and 3 (*perception*) often involved relatively straightforward thoughts that tended to draw on standard pedagogical procedures, and were also often linked to brief *value judgements* (7). These sections tended to involve fewer of the pauses, false starts or paralinguistic features indicative of more complex thought (Butterworth, 1975; Krauss, Chen, & Gottesman, 2000):

Amber L2/R3: I realised that there were three columns$_{(3b)}$ and I didn't want them to make a mistake and put it in the first column$_{(1a)}$ which was explaining what the [laughs] function was of the words$_{(2c)}$.[2]

As such, the majority of thoughts in these categories may be seen as largely *practical reflection* (as defined above): faster, more automated processes that are nonetheless accessible to recall. As may be expected, one of the only discernible sequences of coded data evident across all four teachers was *perception* preceding *value judgement* ($n = 42$), indicative of teachers' noticing something and then assessing its import:

Robin L1/R51: When she says "good question"$_{(3a)}$ I'm, I'm thinking yeah maybe I chose a useful topic to finish the class with$_{(7b)}$.

Recall sections predominantly involving category 5 (*affordance awareness*) and 6 (*uncertainty awareness*) codings tended to correspond to unplanned events, responsive decisions or more complex judgements than those predominantly involving categories 1, 2 and 3, indicative of Schön's ARiA. During such recalls false starts, longer pauses, closing of eyes and more exaggerated paralinguistic features were more likely:

Robin L2/R11: Well I'm thinking how should I help, should I help?$_{(6a)}$ Um I'm also, I'm also thinking why, why after so much practice is it taking her so long to, to recall the phrasal verb$_{(6a)}$ which is a slightly unfair thought$_{(7b)}$ but (.) [rubs ear] yeah if I'm, if that's the first question and she can't remember it$_{(3a)}$ I'm worried a little bit$_{(7c)}$.

Especially sections coded 5a (*intention in response to learner action or contribution*) provided numerous examples of adaptive reflection as teachers responded to learner input. Despite this, their outward behaviour during the lesson rarely indicated significant deliberation. In the following example, a student has asked David about a complex spelling rule. He answers after only a brief pause, and recalls the incident as follows:

David L1/R24: Yeah I'm not [rubbing forehead] completely sure (.) why it's double consonant here$_{(6b)}$. I, I know the rule$_{(2c)}$ he's talking about$_{(3a)}$ and I want to make, I want to show that I know the rule he's talking about$_{(5a)}$: CVC$_{(2c)}$ so I said "consonant vowel consonant" [points finger] to show that I know what he's talking about$_{(5a)}$ um but I think that actually might be more complicated in two syllable words$_{(6a)}$. I, I can't [points at screen and continues playback].

A range of factors seemed to prompt such adaptive reflection, including student contributions, emergent opportunities, time concerns and challenges accessing knowledge or memory, yet they rarely required what Arendt (1971, p. 4) called "stop and think" moments.

Recalls ($n = 76$) that included *reflexivity* were considered sufficiently distinct from those classified as either practical or adaptive reflection to warrant classification as a separate, third type of interactive reflection that was invariably critical. This includes briefer sections coded as *regret/annoyance at own practice* (8a), *self-confirmation* (8b) or *self-criticism* (8c):

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[1] *Value judgements* (7) and *decisions* (4) tended to associate with a range of other categories.
[2] Subscript references in brackets after italicised text (e.g., $_{(3a)}$) indicate the assignment of thought category codes from Table 6.
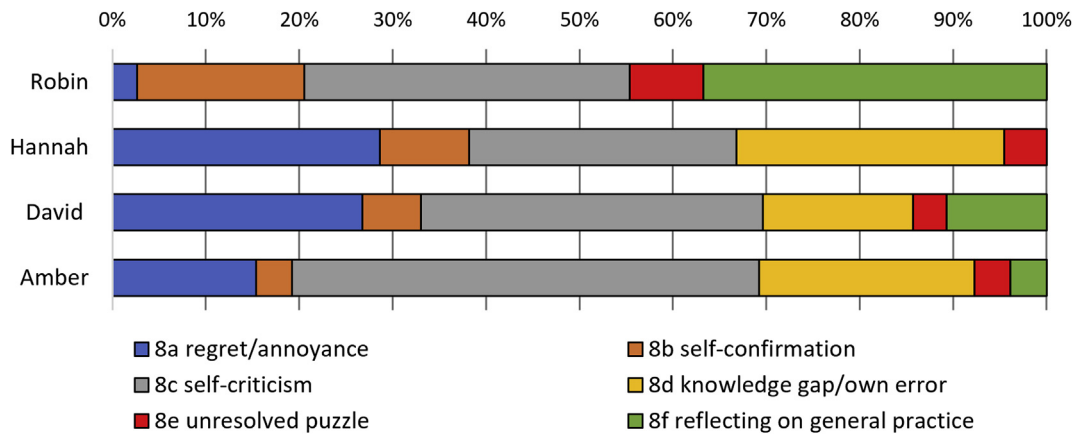
Fig. 8. Relative frequencies of subcategories assigned within thought category 8 (reflexivity) for the four teachers.

Hannah L2/R14: And here I'm thinking that's too open a question. I should've prepared some(8c).

Robin L2/R47: When I think it was Didem or maybe Caroline said 'That's a very good idea'(3a) and there I, I remember feeling a bit bolstered by it all. It's a positive response so I'm like yeah this is a good idea(8b).

Awareness of *gaps in own knowledge* (8d), *unresolved puzzles* (8e) and *reflections on prior/general practice* (8f) often occurred in longer recalls, sometimes indicating a sense of "surprise" as Schön (1995, p. 30) discussed it:

David L1/R50: I'm suddenly self-conscious about the fact that I've looked up 'writ' and I don't want anyone to know that I'm in any doubt as to what 'writ' means, for credibility reasons, not for sort of egotistical reasons(8d) [laughs].

Other longer examples of reflexivity involved more contemplative reflections than Schön's CRiA suggests, with no indication of such surprise:

Hannah L1/R66: And I was, I was quite happy there(8b) cos um like now that I know this class they really trust me and I can say things like "let me check the spelling" or "I need to double check the grammar and I'll get back to you" and they, they kind of like that and they don't expect me to know everything(8f) and I really, I was you know, I really enjoy that about about Yoon-hee especially(8b).

As with other subcategory codings, substantial differences in relative frequencies among teachers were noted. While 8c (*self-criticism*) was common for all, and 8e (*unresolved puzzle*) was generally rare, Robin engaged more than the others in 8b (*self-confirmation*) and 8f (*reflections on prior/general practice*), and Amber in 8c (*self-criticism*). David's and Hannah's *reflexivity* profiles were broadly similar (see Fig. 8).

4.5. Patterns of interactive reflection

While the above analysis suggests the presence of three broad *types of interactive reflection*, a more contextualised analysis of longer (supra-segmental) stretches of transcript data revealed a number of *patterns of interactive reflection*, here organised into six groups:

I. Automated responses
II. Response strategies
III. Internal reflexivity
IV. Recovery strategies
V. Acknowledgement
VI. Face loss incident

4.5.1. Automated responses

Analysis of lesson videos revealed regular events that required conscious decisions, yet rarely prompted recall in the VSR data, here termed *automated responses*. David noted of such events in his post-VSR interview:

I think a lot of what I was saying as I teach reflects or makes very, very clear my thought and there's nothing to say beyond that.

Automated responses were often evident during initiation-feedback-response sequences (Sinclair & Coulthard, 1975), elicitation of answers, and interactions during monitoring of individual work and pairwork. The following example necessarily required a value judgement and decision, yet did not prompt recall:

Robin: Have you ever (.) what was the phrasal verb?

Caroline: See off.

Robin: No not see off.

Caroline: /neɪ/ set off [Robin nods] have you ever set off to go on early, to go on holiday?

It is likely, in the case of *automated responses*, that either the teachers felt no need to comment on them (as David observes), or that the judgements involved may be partly automated, leaving little memory trace to prompt recall.

4.5.2. Response strategies

The term *response strategies* is used to refer to recalls of occasions when unexpected affordances prompted a specific intervention to keep the lesson progressing appropriately, making them

more salient than *automated responses*. They often continued across two or more recalls, but, like examples of adaptive reflection (which they frequently included), *response strategies* were often enacted without apparent difficulty for these experienced teachers, and thus *reflexivity* was rarely prompted. They were fairly common in the data, especially during elicitation, question and answer, and feedback stages. In the following example, Hannah's learners are having difficulty with a picture comparison task from a speaking exam. After realising that a brief example she had provided might confuse the learners, she opts to provide a complete example:

Hannah L2:[3]

R	Lesson transcript	VSR transcript
48	[pictures of two families are showing on the IWB] T: In the first one (.) I'm imagining a rhino …	I was thinking I need the rhino picture$_{(5a)}$ not the one behind me. Why am I pointing at that one?$_{(6a)}$
49	T: … really you want to be answering the question straight away as well so make sure you do that so let's take an example …	And I was thinking should I get them to do an example of that or should I do an example?$_{(6a)}$ And then I thought I'll give them an example$_{(4)}$.

4.5.3. Internal reflexivity

The term *internal reflexivity* is used to refer to recall sections coded *reflexivity* when there was no obvious sign of a specific event (e.g., an instructional shift) to trigger reflection in the observed lesson. Of 22 examples of *internal reflexivity* in the data, 15 came from Robin, and it is possible that they may have been augmented by RoRiA during recall. While some were fairly brief, others were more extensive, as in Hannah's L1/66 example above, and the following example:

Robin L2:

R	Lesson transcript	VSR transcript
5	[teacher has given instruction] T: [slowly] … change these phrases for the phrasal verbs …	Um, I think this is the first point at which I'm thinking, er that there might have been a better way to do this activity$_{(8c)}$. This thought does come up again later. I'm thinking I've given them these cards with the meanings of the phrasal verbs but if I want those phrasal verbs transferred to, to their active vocabulary I guess um the cards should really have the phrasal verbs on, they should be using the questions with the phrasal verbs on,$_{(8c)}$ so yeah.

4.5.4. Recovery strategies

On six occasions, always extending over several recalls, specific affordances or teacher uncertainty led to careful consideration of a challenge or potential problem in ways that always prompted *reflexivity* during recall. Such moments were followed by deliberate action to avert a potentially problematic incident, and, as such, have been labelled *recovery strategies*. While these were rare, they bear strong resemblances to Shroyer's (1981) "critical moments", also rare, yet pivotal events in her data. In the following example, as David discovers that his own knowledge of the noun "markup" is lacking, he moves from awareness of a lack of prior knowledge to self-criticism and regret before getting the lesson back on course:

David L2:

R	Lesson transcript	VSR transcript
10	T: … there's another word that we can use which is um [turns to write on board] "markup".	Yeah, as I turn around to write it on the board I realise that actually my knowledge of this word isn't quite as good as I thought it was$_{(8d)}$ and I'm not completely sure$_{(6b)}$. I know basically what it means$_{(2c)}$ but I but I'm not completely sure about the usage or even if it's usually spelt as one word or two$_{(6b)}$.
11	[Vincent challenges the definition provided]: Vincent: But don't you say "a markup" if it has come to you and you added something complemented it and then sent it back? T: Yeah that is the markup.	I want to sort of move this on now$_{(1c)}$ cos I am a bit out of my depth$_{(8d)}$. I can answer Vincent's definitely right$_{(7a)}$ but um (.) I want to say that he's right$_{(5a)}$ but I also just wanna move things along$_{(1c)}$.
12	T: It's not the version that's being drafted (.) not being drafted. It's being modified, altered …	Yeah I change, I say that the version's being drafted but I change that because I realise that I'm using draft in a way that might cause confusion now$_{(8c)}$ having, having set out [waving fingers away from self] I'm now regretting getting into this whole thing$_{(8a)}$ because having set out to resolve confusion, taking opportunity to resolve some confusion$_{(5b)}$ I think I'm risking creating more confusion$_{(8c)}$.
13	[two students are still confused by "draft", teacher is clarifying] T: If you say draft a contract it just means write a contract. OK?	Yeah so I say, I said that last sentence to try to, I'm trying to [turns head down to the right and waves fingers in slicing motion in front of the image before him] (.) round off summarise sort of put a full stop to, to the um to the topic$_{(1c)}$.

4.5.5. Acknowledgement

On six occasions, usually extending over several recalls, teachers reflected on their acknowledgement of an affordance (often a problem or small mistake) or a lack of knowledge to the learners, either as part of, or as an alternative to, a *recovery strategy*. This always prompted *reflexivity* during recall and was usually also noted in teachers' audio diaries. In the following example, Robin is wrapping up an activity that he felt had been too challenging for the level, and decides to get feedback from the learners. The response of one student surprises him, leading to two distinct self-criticisms:

Robin L1:

R	Lesson transcript	VSR transcript
78	[teacher is summarising the challenge of the activity] T: In general I think I think this was quite difficult to …	As I say that I'm thinking, ah that should have been a question. I should've, I shouldn't tell the student or students that was difficult, I should ask them and then [restarts playback]$_{(8c)}$.
79	T: … what do you think? Didem: No it's good.	When Didem says "no"$_{(3a)}$ I'm thinking yeah that should've been a question$_{(8c)}$ [laughs].
80	T: I mean I think you communicated very well and you asked lots of good …	And now I'm thinking, OK I sort of messed up with that I should probably give them some positives$_{(8c)}$.

Evidence of *acknowledgement* is also present in Shroyer's data (1981, pp. 150–151): "making mistakes in front of the students and admitting them makes for easier rapport with the kids".

4.5.6. Face loss incident

On one occasion a teacher failed to avoid a situation where she found herself in significant difficulty in front of the learners, leading to extended critical *reflexivity* during recall and extensive reflection on action in the audio diary, referred to in both as "my little freak-out", recalling characterisations by two teachers in Shroyer's (1981) study of a "fatal error" (p. 147) and a moment where a teacher felt she "really goofed" (p. 151). In the recall preceding the extract, Amber anticipates the event:

L2/14: I'm about to have my little freak-out where suddenly *I didn't know what any of the answers were*(8d)

She then confirms a student answer, before finding that the teacher's book disagrees with her:

Amber L2:

R	Lesson transcript	VSR transcript
15	Claudia [answering previous question]: "Otherwise"? T [after some deliberation]: "Otherwise," yeah I think so … [she writes it in the column] let's check my guide [opens teacher's book to check. Emphatically:] No! Where does that go then? No. Oh [rapidly] I see, I see, I see! [she deletes and writes it in the other column]	I had a reason for thinking it went there(2c) but somehow I didn't manage to express that to them(7b), so I think that's why I got embarrassed(8a) because I've made this mistake(8d) and then I didn't give an explanation for it(7b) er, yeah.
16	[Teacher is now more cautious before confirming answers. Claudia has suggested "even so" is a conjunction] T: Does everyone agree? Rashid: No. T: Where did you put "even so"?	I think I [laughs] myself wasn't confident about this right now(8d) which is probably why I said: [laughs] Does everyone agree? Possibly if the class had [laughs] if there'd been a consensus I would have just gone with that(6c) [laughs] I'm not sure but I certainly I think this is that point [waves hand in front of face] when I was just like I just lost it(8a). Er yeah that lack of context thing I just saw words(3b) and they, they lacked meaning(6b).

Amber was nonetheless able to get her lesson back on course, deciding to follow the Teacher's Book answers more carefully. She reflects on it in her audio diary later that day, in a clear example of critical reflection (on action):

Amber (audio diary, day 5): When it came to giving answers I just freaked out. It's like I sort of, my mind just sort of went totally blank … and now actually in retrospect … I do think the whole thing would've been better and more effective if there had been examples, even though they're advanced learners, maybe meaning would've been clearer and usage would've been clearer.

Given that only one *face loss incident* was witnessed in over 12 h of lesson observation it seems likely that they are comparatively rare in the practice of experienced teachers. Nonetheless, it recalls examples of "critical incidents" in the literature (see Brookfield, 1990; Tripp, 1993), which may be more common in the practices of novice teachers who lack the *recovery strategies* of more experienced professionals (Goodell, 2006; Griffin, 2003). However, given that critical incidents are often identified and reflected upon after teaching (e.g., Farrell, 2013a; Goodell, 2006), and may not necessarily prompt interactive reflexivity (Tripp, 1993), the label *face loss incident* is used here.

5. Discussion

5.1. A typology for analysing teacher interactive thought

Returning to the first research question, eight broad categories of interactive thought emerged from the inductive coding of the data (see Table 6). Several of these were consistent with prior research (Conners, 1978; Marland, 1977), including *planned intentions, knowledge/memory access, perceptions,* and *decisions.* Others differed from those earlier taxonomies, likely due in part to the focus on reflection in this study: *affordance awareness, uncertainty awareness, value judgement* and *reflexivity.* The apparent consistency of evidence for these eight categories across the four teachers, coupled with the results of the inter-rater reliability analysis provide reasonable support for proposing the categories as a potential typology for the analysis of teacher interactive thought.

While the subcategories described stretch beyond the remit of my research question, they may also prove useful for understanding specific areas of teacher cognition and pedagogical knowledge (cf. Gatbonton, 1999), especially for understanding how differences between, for example, teaching contexts, courses, and teachers themselves influence thought processes. If so, further research is required to establish the validity and reliability of the subcategories within the framework.

Further, although the proposed typology is insightful, it should not be assumed that the categories identified are wholly representative of those thought processes involved during teaching, but only of those available to recall.

5.2. A taxonomy of interactive reflection

Fig. 9 adds the three types and six patterns of interactive reflection from the Findings to the Continuum of practitioner reflection proposed earlier in order to address my second research question. Thought processes grouped together under *practical reflection* (commonly involving *planned intentions, knowledge/ memory access,* and *perceptions*) in 4.4 above and *automated responses* from 4.5 are shown at the practical reflection end of the continuum, consistent with the comparatively spontaneous and effortless nature of such processes. The greater complexity of processes classified as *adaptive reflection* (involving *affordance awareness* and *uncertainty awareness*), and documented in *response strategies* in 4.5, suggests a more central, albeit flexible, position for these processes on the continuum, with different episodes likely requiring varying degrees of deliberation and criticality, depending on whether they involve more familiar, rehearsed strategies (closer to *practical reflection*), or more creative responses (closer to *reflexivity*). Thought processes categorised as *reflexivity* are shown at the critical reflection end of the continuum, consistent with most definitions of reflection in the teacher education literature. The remaining four patterns of interactive reflection are also located here, given the salience of *reflexivity* in examples of these. This diagram is offered as a potential diagrammatic representation, and taxonomy, of teacher interactive reflection.

5.3. Evidence of "reflection-in-action"

Recalls in the data involving *adaptive reflection* and *reflexivity* correspond well to Schön's ARiA and CRiA respectively, as discussed above. Particularly *response strategies* in my data correspond closest to the more instinctual ARiA that Schön identified in the fluent performance of experienced professionals—a "feel for the flow" of the lesson analogous to Schön's "feel for the music" or "feel for the ball" (1983, p. 56) of a musician or baseball pitcher respectively. *Recovery strategies* seem to provide the closest approximation to

Practical reflection	Critical reflection
Spontaneous, rapid thinking about one's practice, often under time-pressure.	Careful deliberation on one's practice and/or beliefs.

<div align="center">←————————————→</div>

Variables may include: duration, complexity, criticality

	Interactive		
Types	Practical - - - > ? < - - - Adaptive - - - > ? < - - - Reflexivity		
Patterns	Automated responses	Response strategies	Recovery strategies Internal reflexivity Acknowledgement Face loss

Fig. 9. A taxonomy of interactive reflection.

Schön's CRiA—events that seem most likely to lead to restructuring of automated knowledge (knowing-in-action). The frequent presence of self-criticism, awareness of the limits of one's own knowledge, and questioning of one's general practice in the data supports this. Further evidence for this assertion comes from the salience of such events, almost all of which were recalled without difficulty and in detail during delayed interviews conducted over one week after the lesson, and were frequently reflected upon in audio diary entries. *Recovery strategies* are rare in my data ($n = 6$), consistent with Shroyer (1981, p. 114), who noted only 20 of her analogous "critical moments" from a total of 421 student difficulties/insights.

5.4. Interactive reflection is more than reflection-in-action

Schön was not a classroom teacher, nor a teacher educator. His discussion of teaching tended to involve examples of 1-to-1 tuition, in which his invocation of Hawkins' "dialogue of I, thou and it" (e.g., Schön, 1992, p. 133) is revealing—"thou" refers specifically to only *one* learner. Yet classroom teaching involves another level of complexity—how one manages learning in the "crowded environments" (Eraut, 1995, p. 17) of classrooms, meaning that Schön's characterisation of RiA, as documented in the practice of architects and psychotherapists, may not apply to teachers (Eraut, 1995). And while this study finds (contra Eraut) evidence to support Schön's notion of RiA, it also finds evidence of other reflective processes.

A key component of Schön's CRiA is the need for the practitioner to carry out "'on-the-spot' experiment[s]" (1983, p. 63) to test new understandings developed through RiA, as exemplified through Quist, his expert architect (1983, 1987). Yet teachers may not be able to carry out experimentation in the same way, due to their need to maintain direction, control and "face" while teaching (Cole, 1989; Shroyer, 1981). This is evidenced in my data in the successful use of *recovery strategies* and *acknowledgement* to avert difficulties and maintain rapport respectively, and in the impact of the *face loss incident* when recovery was not possible (also see Shroyer, 1981, p. 157). It is more likely to expect that experimentation would occur only after a teacher has reflected *on* their practice (after the event) and then planned an "experiment" based on this reflection, constituting a longer reflective cycle (e.g., Kolb, 1984) than Schön's "on-the-spot" experimentation implies. In agreement with this, my data provides no evidence of on-the-spot experimentation, yet it does provide frequent examples of what might be called "micro-improvisation" (often associated with *adaptive reflection* during

recall), for example, when teachers have not thought through an instruction or explanation fully (e.g., Hannah's *response strategy* [L2/R48-9] above), have noticed unexpected learner difficulty or success (e.g., Robin's [L2/R11] recall above), or when specific affordances have permitted digression from a planned lesson (e.g., David's [L1/R24] recall above). However, these tend to be less of the curiosity-inspired "arbitrary" type of experiments evident in the tuition of Schön's architect (e.g., 1983, p. 81), and more of the problem-solving strategies of experienced teachers (see Moallem, 1993) in which the priority is to keep the lesson on track, and to focus on students' learning, rather than their own.

Of further interest to teacher learning are examples of *internal reflexivity*, incidents where teachers appear to reflect carefully on their practice, but only internally, and often when opportunity allows (such as during individual work or group work). The focus on "instructional shifts" in many prior studies of interactive thinking (e.g., Bartelheim & Evans, 1993; Gün, 2014), may have left such reflections unnoticed. While *internal reflexivity* was much more common for one teacher (Robin), and may have become embellished by RoRiA during recall, it nonetheless led to some of the most extensive reflections in the data, including the following example from Amber, the most cautious of the four teachers with regard to awareness of post-hoc rationalisation. It is indicative of potential restructuring of the teacher's knowing-in-action, but with no apparent "surprise", "artistry" or "experimentation" as Schön (e.g., 1983) predicted:

> Amber L2/R7: When I was using the Internet the thought crossed my mind about whether you, whether I was, whether one loses sort of credibility when one goes to the Internet in the eyes of the students(8f). I think it's just a thought that came into my mind at some point [waves hand up in the air] … because maybe I was feeling self-conscious about the fact that I couldn't come up with an example just like that(8d) and I had to go to the Internet, um and I did it a few times so I feel like that was a thought that I had at some point was: do, do I still seem credible despite that?(8f)

6. Conclusion

6.1. Limitations of this study

While this study has attempted to follow best practice

guidelines in the use of VSR to access interactive thought (e.g., Borg, 2006; Gass & Mackey, 2017), the claims made above must remain tentative, cognisant of the limitations of this method, the small scale of the study, and the limited amount of data collected. They should also remain subject to verification through other research designs, including those avoiding VSR (Yinger, 1986), those using more random sampling (both of participants and lesson segments for analysis), and those conducted in other teaching and learning contexts, especially primary and secondary, where classes are larger and behaviour management more challenging. It is possible—even likely—that studies in such contexts will find fewer examples of critical reflection, particularly *internal reflexivity* (see, e.g., Shroyer, 1981; Moallem, 1993).

6.2. Potential value of this study

This exploratory study has used triangulated VSR interviews to investigate teacher interactive reflection, bringing together an attempt to inductively code thought types with a focus on reflection that is, I believe, original. While a number of studies (e.g., Gün, 2014; MacKinnon, 1987; Martinelle, 2017; Roe, 1990) have attempted to investigate teacher interactive reflection, these have largely failed to separate RiA from RoA. The only study that documents RiA extensively (Shroyer, 1981) did so for a different purpose, and involves no analysis of the reflection documented. Given the general lack of research on interactive reflection in the literature, the conclusions that follow are accompanied by several suggestions for further research and practical use.

Firstly, this study provides an empirically developed typology for the analysis of teacher interactive thought that builds on that of Marland (1977, 1986) to incorporate more reflective processes, appropriate to more recent understandings of teacher cognition and learning (Borg, 2006). Further studies, particularly in other classroom types, will be important both to evaluate the usefulness of this typology and to develop it further. Teachers may find the typology useful in understanding their own thought processes, either retrospectively (Schön's RoRiA), or interactively, enabling them to develop greater self-awareness, an important prerequisite to effective teacher reflection and development (Farrell, 2013b; Walsh, 2003).

Secondly, sufficient evidence is presented to indicate that experienced teachers do engage in conscious interactive reflection that, at least at times, appears to be formative. This includes support for Schön's concept of reflection-in-action, with a number of such incidents empirically documented. However, it also documents other types and patterns of interactive reflection not mentioned by Schön. This includes the finding that some of the reflection of the teachers involved was internal and frequently self-critical. Instead of Schön's on-the-spot experimentation (1995), I have suggested that "micro-improvisation" may be a more useful construct to describe the responsive improvisatory practices of teachers, the highlighting and analysis of which may be of practical use to trainee and novice teachers in their pre-service and early career development. The taxonomy of interactive reflection proposed in Fig. 9 offers a tentative framework for understanding these processes.

Thirdly, this study provides ample evidence of teachers engaging in adaptive reflection, largely as Schön predicted (1983). Exactly how much of this is automated and how it impacts on teacher learning remains to be confirmed. However, both the types and the patterns of interactive reflection described above are consistent with a more graded continuum between knowing-in-action and RiA as Schön suggests (1987, p. 29), and also consistent with Cleeremans and Jiménez's (2002) Dynamic Graded Continuum (DGC) that offers a "depiction of the dynamics of how a

particular representation will change over the different time scales corresponding to development, learning, or within-trial processing" (p. 23). Analysed from a DGC perspective, potential examples of ARiA in the data may involve representations on the border between explicit cognition and automaticity. CRiA could be analogous to moments when "normally automatic behaviour … suddenly becomes conscious because the normal unfolding of the behaviour has been interrupted" (p. 25)—Schön's "surfacing" (e.g., 1983, p. 241)—that in turn allows for control and restructuring of the representations through critical analysis.

Fourthly, this study also documents a notable variation in recall frequency and type among the participants that is worthy of further research. It may relate to contextual factors (who is teaching what to whom, where and why), to individual differences in personality or teaching style, and also to length and breadth of teacher experience. For example, are Amber's vaguer recalls due to less experience, less reflection, her choice of lesson activities, or simply greater caution during the recall process? Does Robin's more frequent reflexivity indicate that he is learning more, that he is overly self-critical, or that he is engaging in more frequent post-hoc reflection? Improving our understanding of such differences, may (on a theoretical level) shed light onto how teacher expertise develops, and (on a practical level) provide teachers with useful insights to help them develop those reflective processes that may lead to deeper learning. A study using a similar design, but comparing the same teacher working on different programs, or experienced and novice teachers on the same program may shed light onto factors influencing these variations.

Finally, a number of terms and constructs are introduced in this paper, including a continuum of teacher reflection (see Fig. 1), terminology for the description of teacher interactive thought processes (see Table 6) and six patterns of teacher interactive reflection. Such terms may be useful for researchers, teacher educators and teachers themselves in developing reflection literacy - the ability to identify, describe and discuss reflective practices coherently.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tate.2019.102879.

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