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Multimodal Discourse Analysis and Electronic Devices: A Pilot Study on Emotionally Supported Evidence

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Communication is multimodal in its very nature. In recent decades, research interest in this topic has grown exponentially, especially from a Multimodal Discourse Analysis (MDA) standpoint. Within academic settings, several studies have looked at lecturers' combinations of verbal and non-verbal features, but not necessarily in relation to the emotions that are implicitly part of lecturing. We believe that teaching involves transmitting knowledge together with emotions to students, more or less consciously. This may even be more relevant in an English Medium Instruction (EMI) setting, as English is not the instructor's main language. Thus, our main aim is to analyse an example of EMI teaching practice from an MDA perspective but adding an electronic device—an electroencephalograph—that can help us improve and/or complement the analysis in different ways: adding more objective support and dealing with the emotions lecturers can transmit when delivering their classes. Results show that this combination of observation and technology can potentially enrich results from traditional MDA research.

Keywords: Multimodal Discourse Analysis; English Medium Instruction; technology; electroencephalograph; emotions

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El análisis del discurso multimodal y los dispositivos electrónicos. Un estudio piloto sobre evidencias apoyadas emocionalmente

La comunicación es multimodal por naturaleza. En las últimas décadas, el interés por investigar este tema ha crecido exponencialmente, sobre todo desde el punto de vista del

análisis del discurso multimodal (MDA en inglés). En entornos académicos, varios estudios han analizado las combinaciones de características verbales y no verbales del profesorado, pero no necesariamente en relación con las emociones que forman parte implícita de su labor docente. Creemos que enseñar implica transmitir conocimientos junto con emociones al estudiantado, de una forma más o menos consciente. Esto puede ser incluso más relevante en un entorno en el que el inglés sea el medio de instrucción (EMI en inglés), ya que éste no es el idioma principal del personal formador. Así, nuestro principal objetivo es analizar una práctica docente en inglés desde un prisma del análisis del discurso multimodal, pero añadiendo la utilización de un dispositivo electrónico—un electroencefalógrafo—que puede ayudar a mejorar y/o complementar el análisis en otros aspectos: añadiendo una estructura más objetiva y abordando las emociones que el profesorado puede transmitir en sus clases. Los resultados muestran que esta combinación de observación y tecnología puede implicar una perspectiva válida con la que enriquecer el análisis del discurso multimodal.

Palabras clave: análisis del discurso multimodal; inglés como medio de instrucción; tecnología; electroencefalógrafo; emociones

1. Introduction

Communication is not only based on the ideas we aim to transmit, but also on the conceptualisation that is needed and what we do to communicate those chosen ideas. As Drucker said, "[t]he most important thing in communication is to hear what isn't being said" (quoted in Moyers 1989, 408). As such, Multimodal Discourse Analysis (MDA) in academic settings is a research topic which has been employed for some time now (see, for example, Crawford-Camiciottoli and Fortanet-Gómez 2015). In a technological world such as the one we live in, we should expand the common research methods of MDA. Some fields (e.g., marketing, product design, language learning) are already integrating technological advances into their research, such as face recognition systems and eye-tracking tools, among others, and there seems to be a growing number of apps concerned with emotions (Doerrfeld 2015). The present study tries to open a new path in MDA by demonstrating how to use a technological tool and the analysis of certain facial movements to complement our own MDA analysis, and widen the study by examining some of the emotions that the subjects—teachers—analysed may feel and/or transmit in their teaching, in our case, within an EMI context.

This article will start by explaining the theoretical support regarding MDA, emotions and electronic devices and the particular EMI context of the research. The methodological section will include a description of the tool used in our study—Emotiv EPOC—a helmet-shaped electro-encephalograph, as well as the procedure applied. The next two sections will deal with the discussion of the results, and finish with some conclusions.

1.1. Multimodal Analysis of Spoken Academic Discourse

Teaching is not a simple task. Lecturers often have to adapt their messages to the audience they have, and classroom discourse has to be carefully considered before interacting with the students. We understand classroom discourse as the talking conducted as part of instruction, but which also functions as its own vehicle (O'Connor and Snow 2018). The analysis of oral discourse as a part of the teaching and research activity has tended for a long time to focus on the study of the discursive aspects employed by the lecturer in charge of a session (Diani 2008; Mauranen et al. 2010; Björkman 2011; Bowles and Cogo 2015). Nevertheless, studies on communication in recent decades, as well as more recent trends in the field of discourse analysis (cf. Crawford-Camiciottoli and Fortanet-Gómez, 2015), have shown that most of what the audience understands in these sessions has a lot to do with non-verbal elements (body language, tone and volume of voice or gestures, among others). Thus, according to Menéndez (2012, 58; our translation), "multimodality is an inherent and necessary characteristic for discourse analysis, simply because discourse is a basically multimodal unit." As a result, it is important not only to analyse the concepts that people communicate orally in their teaching, but also how paralinguistic elements help to develop the message and transmit it properly when dealing with an audience. According to Stöckl (2004), the concept of multimodality involves artefacts and processes that combine various systems of signs, combining the independent meanings of each mode in order to create a new meaning. The term *mode* refers "to the various elements that are capable of conveying meaning in communication" (Bernad-Mechó 2018, 79), such as language, gestures and visual aids in spoken academic discourse.

Non-verbal communication is often defined as a combination of paralinguistic, kinesic and proxemic elements which accompany verbal communication, with the main aim of broadening the receiver's understanding of the speaker's objective (Rahman 2018). Receivers pay attention to verbal and non-verbal aspects at the same time, complementing the transmission of a message. Thus, our physical language is not, per se, positive or negative: both the situation and the message will determine the receiver's understanding. In fact, in some areas (such as persuasive discourse), the importance of non-verbal aspects of language prevails over those that are merely verbal (Preston 2005).

Researchers have observed that the message is often conveyed not only by words, but also by a vast amount of modes that are used by the speaker in order to increase the listener's understanding. Multimodal Discourse Analysis focuses on the way different modes combine in order to send a message in a successful way. As mentioned above, discourse is multimodal when its meaning "is realized through more than one semiotic code" (Kress and van Leeuwen 1996, 183). What MDA studies is the possibility of analysing all those various codes together, in an integrated way. While traditional discourse analysis has paid attention to modes individually, MDA wonders if "the meanings of the whole should be treated as the sum of the meanings of the parts, or

whether the parts should be looked on as interacting with and affecting one another" (Kress and van Leeuwen 1996, 183).

From the various seminal studies that have allowed the methods of discourse analysis to be deepened and applied to various semiotic studies (Kress and van Leeuwen 1990, 1996, 2001; Norris 2004; O'Halloran 2011; Kress 2012), some linguists have reached a conclusion, which was noted by Scollon and LeVine (2004), and later ratified by Kaltenbacher:

> Linguists have realized that there is no pure monomodal discourse; that spoken language does not exist without accompanying gestures, grimaces, body posture and eye movement, in the same way that written texts cannot exist without frames, spaces, typography or colour. Therefore, what we [linguists] saw was not, in fact, a change of attention from mono- to multimodality, but the recognition of the completely modal nature of every text (2007, 37; our translation).

Teaching professionals must first understand this multimodal nature of communication (Morell 2018). The way lectures were understood in the past has changed, and the conceptualisation of the lecture needs "to be expanded from a more traditional focus on verbal communication and text to include the non-verbal, multimodal and socio-material character of lectures" (Lackovic and Popova 2021, 535). All the different modes should interplay in order to convey a message from a semiotic perspective. As Bernad-Mechó (2021, 183) points out, the study of "how different modes contribute to the creation of meaning as well as how this interrelationship itself works in the meaning-making process is paramount" within this new framework. Nonetheless, the combination of all these modes can have an effect on the way lecturers behave while teaching. Thus, if their aim is to become good speakers, they should also learn how to exercise some control over their emotions. This is where practice comes into play, allowing the lecturer to address any possibility of stage fright or social anxiety (Amir et al. 2008), these being based on the development of negative thoughts that act as a constraint for the speaker when facing an audience. Although it is observed more frequently among less experienced speakers, emotions can negatively affect the task of lecturing through the lecturer developing a natural defence mechanism when facing the logical uncertainty implied by an oral session. Practice will reduce that feeling of anxiety.

1.2. On Emotions—and How to Measure Them

Emotions cannot be disassociated from our daily life. As Cacioppo et al. (2001, 173) state, "emotions guide, enrich and ennoble life; they provide meaning to everyday existence; they render the valuation placed on life and property," reinforcing the idea that the relationship with our physical world is emotional. It is difficult to define

emotions, but the idea that they are a multifaceted phenomenon consisting of several components seems to be accepted. Desmet (2003, 113) divides them into "behavioural reactions (for example, approaching), expressive reactions (e.g. smiling), physiological reactions (e.g. heart pounding) and subjective feelings (feeling amused)." Hernández and Cárdenas (2014) point out that emotion is paramount to the human experience, as cognition influences perception and daily tasks (including learning, communication and even rational decision-making). According to some other authors (Quartz 2009; Harrison 2013), emotions influence people's decisions, the effectiveness with which they learn and how they communicate with others.

Various proposals regarding the theories of emotion have been postulated since the ninteenth century, and many of them still have an influence today in the epistemological community (Hamdi et al. 2012). One of the problems observed when recognising emotions is linked to its definition and the diverse types of emotions that can be distinguished. Ekman and Friesen (1978), for example, proposed a model that relies on universal emotional expressions to differentiate between six primary emotions—fun, sadness, anger, rage, disgust and surprise.

Additionally, other scholars have identified emotions through different modes, such as voice or facial expressions (Pantic and Rothkrantz 2000). However, researchers have found that it is relatively easy to mask facial expressions or simulate a certain tone of voice (Chanel et al. 2007). To overcome this, some studies have required the combination of other signals to validate the results—such as, for example, monitoring heart rate—to distinguish between anger, fear, disgust or sadness when dealing with younger and older participants (Levenson 2003). Psychological signals such as Electrocardiogram, Electroencephalography or Electromyographic Facial Activity, among others, are often used to complement the analysis of emotions.

As Royo-González (2016) describes, there are many different ways and techniques to collect data on emotions. Her work explains, argues and exemplifies three of them:

a) Surveys, semantic analyses and pictograms that focus on the subjective details of the study.
b) Facial recognition and voice analysis, focusing on the physiological component of perception.
c) Neuronal response, which collects neurological, physiological and cognitive information.

Our line of work related to MDA focuses on facial and body features—although we also complement this study with the measurement of neuronal responses—in order to have a more complete image of how the brain works in some specific situations. Disregarding the technical specificities of how the brain is structured or how it organises information, we must indicate that electroencephalography is a non-invasive technology that "refers to the phenomenon that collects electrical activity along

the skull, while the electroencephalogram (EEG) collects the signals obtained by measuring voltage fluctuations/variations due to the flow of electrochemical current in the neurons" (Royo-González 2016, 51; our translation). These EEG signals can be used for emotion recognition and can be classified with an accuracy of more than 60% or 70% according to previous studies (Choppin 2000; Bos 2006; Nie et al. 2011).

Despite being immersed in a time when new teaching methodologies are being implemented—such as cooperative learning and problem-based learning—and giving greater emphasis to the role of the student, it is also a fact that the role of the lecturer as transmitter of knowledge is still undeniable (i.e., Benito and Cruz 2005; Zabalza Beraza 2011). This teaching role—which we do not assume as necessarily unique in the classroom and can be performed just for a short time every lesson—is what is of relevance in this study, which aims to better understand how the lecturer communicates in the classroom. Specifically, we are interested in knowing how lecturers' non-verbal language is reflected in the sessions they give, assuming that this type of resource can help lecturers to complement their verbal communication in an effective way as many other works have previously stated (Bernad-Mechó 2018; Valeiras-Jurado and Ruiz-Madrid 2019, among others).

In addition, this fact seems even more relevant if the object of our analysis is lecturers using English as a vehicular language, that is, English Medium Instruction (EMI) lecturers, for whom English is an additional language. Some studies have focused on the lecturer's beliefs and concerns when teaching in English. One of them (Doiz et al. 2019, 169), in line with and supporting previous studies (e.g., Fortanet-Gómez 2013), found that "lecturers are preoccupied with the challenges resulting from using English to transmit content [...] in three specific areas: teaching in a foreign language, the impact of English on the development of the classes, and the students' language skills." Regarding the first, lecturers mention insecurity as the key negative factor. This lack of confidence is the result of several challenges: lecturers may not be able to sort out their own language problems, tend to be required to invest considerable effort in preparing and delivering lessons and consequently may feel tired during the lesson, or may be inexperienced in EMI. All these reasons "can also result in a noticeable emotional handicap for some of them" (Doiz et al. 2019, 169). As for the two other areas mentioned, we also understand that lecturers might feel uncomfortable, and/or may find it hard and difficult to deal with those EMI lessons, all affecting the emotional attitudes of lecturers.

1.3. Electronic Devices to Analyse Micro Gestures and their Emotional Meaning

Non-verbal aspects of communication can be analysed by means of detailed observation—accompanied by a video and audio recording—and the subsequent categorisation of the gestures involved made with any part of the body—including head, hands or facial movements—as pointed out by Alugupalli et al. (2011) and in

various chapters in Crawford-Camiciottoli and Fortanet-Gómez (2015). However, technology is advancing in its capacity to support this type of research, it now being possible to accompany the analysis of gestures with the analysis of emotions (Puig-Martí and Bolta-Escolano 2014). In this sense, our interest in body language is complemented by our interest in analysing the emotions generated by lecturers when speaking in public, and the notion that—albeit perhaps less consciously—they also transmit information throughout these paralinguistic features, something that can affect the student learning process.

Employing electronic devices to analyse people's emotions has become fairly popular in recent years (Doerrfeld 2015), although mostly they are used by marketing specialists to evaluate potential consumers' tastes and, therefore, being exploited more for commercial than academic purposes (Puig-Martí and Bolta-Escolano 2014; Royo-González 2016; Aucejo-Devís and Pocoví 2017, among others). There are several systems on the market that try to recognise emotions through the analysis of facial micro-gestures (Doerrfeld 2015). Nevertheless, to our knowledge, no research has been carried out to date on interweaving an MDA with the use of an electronic device within an academic context. Thus, it is our aim to focus on micro-gestures and body language in relation to university lecturers' emotions while teaching, observing how they help to enhance communicative performance in the classroom. To do so, we will study this teaching activity from an MDA perspective.

1.4. The Current Study

The current article has two basic objectives. First, we would like to show the contribution that can be made by an electronic device to the study of emotions and certain non-verbal features in teaching, in our case in an EMI context. Second, we would like to illustrate how this device can complement data from a traditional MDA and ensure scientific rigour in the achievements obtained to date in the field.

2. Methodology

The process of analysis combined two actions: a) a traditional MDA—based on observation and annotations of the different non-verbal and verbal features; and b) the use of the electronic device. Both types of analysis had to be combined. Thus, we initially relied on the electronic device's results, supplementing them with the MDA analysis of selected excerpts.

2.1. Electronic Device: Emotiv EPOC

We studied how one EMI university lecturer introduced the lesson contents, delivered in English, in theoretical-practical sessions. To do so, in addition to the video-recordings of the sessions and their later analysis, we also analysed certain non-linguistic resources

employed, specifically, facial expressions, using the Emotiv EPOC device: a helmet-shaped electro-encephalograph that employs electric signals in the brain to make connections between facial movements and emotions expressed during the speaker's performance. This instrument has been used in other research fields (cf. Royo-González 2016), although not specifically in (multimodal) discourse analyses. The relevance and usefulness of this device was explained in more detail in Ruiz-Garrido and Palmer-Silveira (2019).

The headset is specifically designed for scalable and contextual human brain research, and it is relatively easy to use. It provides access to professional grade brain data through the use of fourteen saline-based electrodes. Those electrodes send wireless signals to a computer, offering data based on the speaker's emotions. This device reduces experiment setup time; as one single helmet is used for a person, everything can be ready in less than five minutes, and the data collected can help us to understand better how lecturers' emotions are involved in their day-to-day teaching activity.

2.2. Procedure

As mentioned above, we are using as the object of our research an EMI lecturer teaching on a Master's Programme at a Spanish university, who introduces his contents in theoretical-practical sessions. Our final aim is to contrast whether the body language of the lecturer analysed can be corroborated and/or expanded upon by the EEG data and the analysis of emotions. This study was carried out with the collaboration of technicians expert in the use of the Emotiv EPOC system, and also in the processing and interpretation of the data compiled.

The EMI lecturer participating in this study is an experienced male lecturer, in his early forties, who has been involved in EMI lecturing for over 6 years on undergraduate and master's courses. He has a C1 level in English. We recorded one of his teaching sessions on the subject of *International Business Management*. Specifically, it was session twelve out of fifteen sessions that the lecturer gave to his students; in the recorded session, he was introducing his sixth of seven topics covered in the syllabus. This implies that the students already know him well, and they are also aware of his lecturing style. Some rehearsals were carried out prior to the study data being collected so that the instructor and the staff working with the video cameras and the Emotiv EPOC could get used to the situation. Students were not present during these rehearsals.

The day of the experiment, we videorecorded the whole session, which lasted two hours. However, we decided to use the helmet for a limited number of minutes—25, later focusing on 77 seconds for our MDA analysis. The analysis was first performed using the electronic system, and subsequently corroborated through the analysis of the recording by the authors, assisted by one of the experts in the use and interpretation of the data derived from the Emotiv EPOC system. A few days later, the results were contrasted with the recorded lecturer to confirm the initial results and the validity of our interpretation.

The piece of the lecture analysed is brief, due to its piloting nature and the limitations detected before, during and after the recordings. For the study—although working with a wireless helmet—the lecturer was recommended not to be far from the computer linked to the helmet and not to move very much, which was done in order to ensure that the data input received was as large as possible. Therefore, the final position chosen by the lecturer from which to impart his class was standing up in front of the desk or leaning on it (see figure 1). The computer monitors were on his right—one static non-functioning monitor on the table and a working screen on an articulated arm. The classroom screen was behind the lecturer to his left so students had an unobstructed view of it. The technician controlling the electronic device sat at the side of the table and so did not interfere with the development of the class.

FIGURE 1. Classroom set up

During the experiment, the technician was responsible for the correct functioning of the helmet and its monitoring. During the uploading of the data, we identified moments—short periods of two/three seconds—of data loss due to technical issues. We noted these errors and checked them later. Based on this, our current dataset focuses on 77 seconds of recording where there were no changes or interruptions to ensure the reliability of our results. During the recorded segment analysed, the lecturer was leaning on the table and looking at the table monitor. Although short in duration, the data set obtained from the recording itself—as well as the later interview with the lecturer—provides a clear picture of the potential this device—or similar ones—can offer in future studies.

The recording extract that we analyse was from minute 5.00 to minute 6.17 of our original recording. The Emotiv EPOC system is able to reflect the following emotions:

- ST (short term) and LT (long term) excitement: these terms refer to the emotion, feeling or awareness of physiological activation; in the short term it indicates a reaction to sudden stimuli (for instance, a door slamming), while in the long term it points to the general mood of the person studied.
- Interest / Boredom: it refers to the state of alertness that a person experiences, as well as the conscious direction of attention towards a specific stimulus relevant to the task.
- Meditation: it is the most relaxed or most reflective state of concentration.
- Frustration: it refers to the degree of negative feelings (upset) as a result of not being able to change or achieve something.

Additionally, the electronic device also provided information about the lecturer's eye movements, indicating whether eyes were closed—both eyes at the same time, i.e., blinking, or just one, i.e., winking—or open, and even the direction they were looking in.

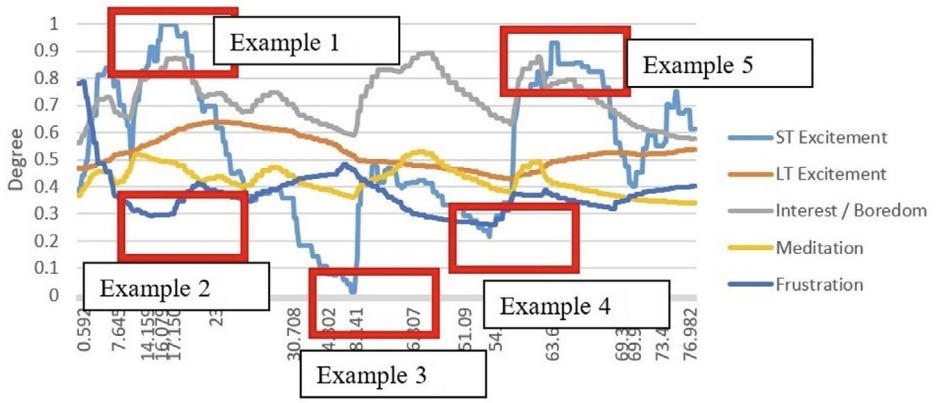
These first steps in the analysis were complemented with the MDA of the video recording, based on the discourse uttered by the lecturer, along with the non-verbal language used—facial as well as hand and arm movements. For the annotation of the dataset, we adapted previous taxonomies already applied in MDA studies (e.g., Querol-Julián and Fortanet-Gómez 2012, 276; Bernad-Mechó 2018, 192). Finally, to complete the full analysis, an interview with the lecturer was conducted. Its purpose was to confirm or modify our interpretation of the results, or even try to find an explanation for our findings.

3. Results and Discussion

As mentioned above, the first aspect we were interested in dealing with was the emotions and its detection with the Emotiv EPOC headset. Figure 2 shows the overall results of the analysis and some marked examples—chronologically numbered—which will be explained below. As can be seen, emotions operate in various ways in the period analysed:

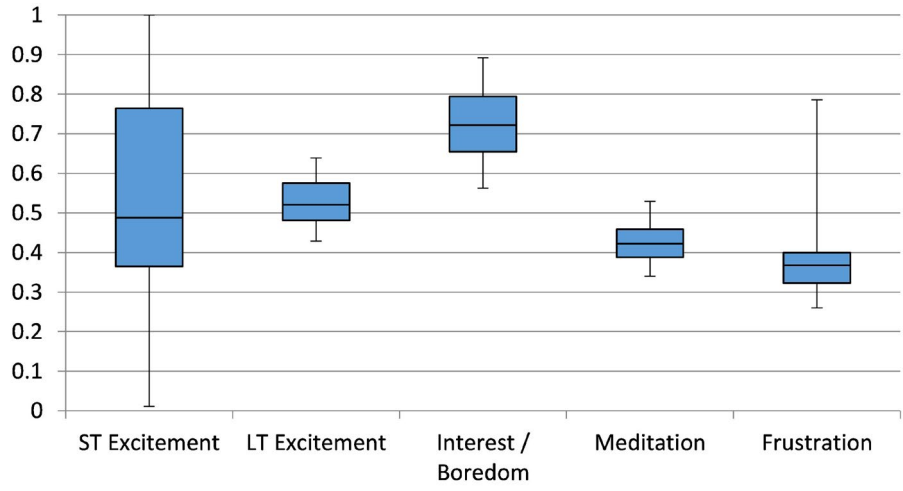
- ST excitement oscillates in a notable way, indicating changes that deserve our detailed analysis, particularly the spikes.
- LT excitement remains quite stable throughout the recording.
- Interest/Boredom is relatively fluctuating, but levels remain within similar parameters.
- Meditation is quite stable.
- Frustration is also quite stable, except in the beginning of the recording, where a sudden increase is seen, and levels become quite high.

FIGURE 2. Results from Emotive EPOC



These data can be corroborated by studying the boxplot (figure 3), where it can be seen that ST excitement is quite uneven in terms of distribution. LT excitement is clearly less dispersed, and in an intermediate range. Higher than any other element, we can see the results of the interest/boredom emotion, where the median line centred within the box and the balanced whiskers suggest a balanced distribution of data around the median. Meditation is represented in a low and steady way. Finally, frustration shows considerable dispersion, although the tendency is towards the lower zone.

FIGURE 3. Boxplot representation of emotions



In addition, other data that are useful to us in our research are the facial features that can be observed in this brief excerpt (table 1).

Table 1. Eye-movement actions

Actions	**Occurrences**
Blinking	9
Open eyes	399
Left wink	33
Right wink	4
Total number of eye movements detected	445

Overlapping eye-movement actions	**Occurrences**
Looking to the left	10
Looking to the right	38
Looking up	0
Looking down	0

According to these results, the lecturer's most frequent position was with his eyes open. Overlapping eye-movements refer to occasions where the lecturer was not looking directly in front of him. In our case, only left or right movements were detected. In these cases, there was a greater tendency towards the right and, according to raw data, on a couple of occasions, those looks lasted longer.

The data was checked with the lecturer participating in the study, trying to confirm or find out the reasons why these differences could be detected. The lecturer corroborated our understanding of the recorded data, indicating that using his eyes was necessary to establish a closer contact with his audience, trying to observe all his students, and the greater time devoted to the right side of the classroom was because most students were located in that area of vision. He also supported our interpretation of the results regarding emotions, explained below.

In this sense, following on from the general results, we focused our attention on five specific situations providing information that is more relevant from the perspectives of both emotions and MDA. As seen in figures 2 and 3, long-term excitement, interest/boredom or meditation give us little data because the results show relatively high stability and little dispersion across the recording as a whole. The interpretation of the results observed suggests that:

- The lecturer's mood was stable, despite taking part in an experiment and being in a fairly unnatural environment—being recorded and wearing an EEG helmet.
- His state of alertness and his degree of conscious attention during the lecturing process were both relatively high, indicating his professionalism.
- His state of concentration supports the two points above: the situation did not generate any further nervousness to the lecturer, who remained in a relatively relaxed state.

In this experiment, the emotions that seem to offer more information about the lecturer's activity are short-term excitement and frustration. Regarding the former, the dispersion is wide. In figure 2, a couple of relevant peaks can be observed in terms of the degree of excitement: those happen at 16.079-17.150 seconds (example 1), and at 63.624-63.989 (example 5), both showing levels higher than 0.9 out of 1. There is also an example of a low point of short-term excitement, between 34.302-38.141 seconds (example 3). Additionally, we have also highlighted two examples of low degrees of frustration. One overlaps with the peak of short-term excitement in example 1 (example 2, between 14.159-17.150), and the second (example 4) with the low level of short-term excitement at 51.09-54.22.

It can also be seen in figure 2 that, when the ST excitement reaches its peak, the lowest point of frustration is 0.29. Table 2 describes what happens from an MDA perspective while the lecture utters the expression *I don't like selling things {slight silence} but my job is selling things* [slight silence] *you know*.

TABLE 2. Analysis of an excitement example (example 1 in figure 2)

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
11-13	*I don't like selling things,*	Looks at Ss Left-arm elbow flexed and resting on a screen on the table Palm inwards Relaxed left-hand fingers	
13		[slight silence] Moves left-hand slightly Ends by moving just eyes (no head) looking more to the right	
14	*But*	Looks back to the centre (only eyes)	
15-16	*my job is selling things*	Voice emphasis on *my job* A bit of smiling when *selling things*	

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
17-18		[Silence looking from right to left and centered on students again]	Eyes blinking (system detected)
19	*you know…*	Left-hand fingers are stretched out and relaxed A little nod is made by the head and head moves to the right to see all Ss Eyes move towards right	

It is in the moment of silence before *but* that the speaker's excitement reaches its peak as he—in addition to a brief blinking of his eyes (confirmed by the Emotive EPOC system)—slows down his pace while he is thinking of a clear example to illustrate his explanation. We initially speculated that this ST Excitement might reflect the search for the example. However, the lecturer clarified that he was indeed constructing the discourse to express the example but, at the same time, he was also using the slight silence as an attention-getting device. This intense cognitive activity resulted in a high degree of ST excitement.

Regarding the level of frustration, it is quite low during the recording, and the lecturer seems comfortable during his activity in the classroom. However, we should also point out that, interestingly, that level of frustration was quite high at the beginning (initial seconds) of the recording analysed, as depicted in figure 2. At that point, the level of frustration was 0.78, while the level of ST excitement was just below 0.5. The reason for this particular situation is due to a beep sound coming from the multimedia table, which occurred unexpectedly at the beginning of the analysed fragment. Data coming from the helmet confirmed that the level of frustration showed the teacher's great degree of discomfort with that noise, as he was not able to avoid the sound that interrupted to some degree the continuity of the teaching activity. However, once this passed, the level of frustration diminished considerably. In fact—and for the rest of the time analysed—this emotion was in a quite stable and medium-low position, never again reaching the initial point shown in figure 2. This could show that any negative emotion may affect the teaching for some time (often brief), even though the lecturer's teaching may not be disrupted, probably due to his long-term experience. As a result, this part of the analysis suggests that experience can overcome any kind of frustration with an external cause during a lecture.

TABLE 3. Analysis of a frustration example (example 3 in figure 2)

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
34	*Imagine that*	Looking down… as if thinking	
35-36	*you were working at Bankia*	Long *were* Head up a bit and tilted to the left Gaze to the right Pitch emphasis when *Bankia* + short head movement up and down	Left wink (system detected)
37-38	*and you have to sell preferences,*	Head movement to the right Head movements up-down, slightly nodding Eyes open wider, especially his right one (as a result of the upwards movement of the eyebrow) Smiling when *preferences*	
39	*you know that …*	Still half-smile Head moves a bit more to the right Gaze more to the right Pitch down, difficult to be heard	
39-40	*products*	Slight silence before the word Right arm and hand upwards Right hand makes a kind of signal using thumb and index finger (as if indicating something short or small) Then, right hand comes back to its initial place (close to the left one, holding the optical pencil between both)	Metaphorical meaning of *products* like a small object

Example 3 illustrates the lowest point of ST excitement, which is observed—and was endorsed by the lecturer—when he explains concepts already internalised or shared previously with the audience, which do not require great mental effort, something that he uses repeatedly—these being techniques used regularly in EMI sessions—see, for example, Khan (2018), who also went on to identify 25 different strategies used by non-native EMI lecturers in their classrooms. This is shown in example 3 (figure 2), when the lecturer illustrates a previous concept that has already been shared with the audience. This time, the speaker combines head movements—head tilts to the left,

then to the central position, as well as other short movements up and down—, gaze—looks down, then at students, and to the right—, a half-smile at certain moments and very limited hand movements with a clear meaning—hands are linked by means of an optical pencil, only the right hand moves to metaphorically reference a small product, and back to a relaxed position holding the pencil close to the left hand. He finishes this ensemble of verbal and non-verbal modes with a slight silence, and then the ST excitement increases very sharply when he makes a funny comment as part of the example explained (he says *So, you don't like it*, after second 40). This reflects that the example is a common explanation for the lecturer, but after it, he expresses an opinion related to the example, which makes his emotions show a more personal aspect of his feelings, and this is something that lecturers may transmit to students as well. It seems, then, that the lecturer is in full control of the classroom; he decides where and when to stress concepts that results in a sudden increase in the level of excitement.

Table 4. Analysis of a short-term excitement and frustration example (example 4 in figure 2)

Timing (0-77 seconds)	**Discourse (Verbatim)**	**Lecturer's non-verbal language**	**Additional comments**
49	*So, these situations are*	Right hand moves from palm down to palm up (referring to *these situations*) Left hand (although resting on the screen on the table, moves as well) Hands palm up; separated; left hand holding pencil Both hands move a bit upwards and downwards Gaze to the right; eyes wide open	Metaphorical hands movement
51- 52	*kind of a situation where*	Suddenly, an abrupt movement occurs: Turn head, and body slightly, toward the screen on the left (which shows the same as the screen behind him; the one students look at) The pencil changes from being held in the left hand to the right hand Right hand moves to a resting position on the lecturer's lap Left arm is not resting anywhere. It is stretched out towards the computer screen (without touching it), pointing at the screen with all the fingers (separated) at the same time. Then, it moves towards the lecturer when he says *where* (palm down, and fingers joined)	

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
52 – 54	*all the {unintelligible} can be, okay?*	Arms and hands move making circles in the air The lecturer is still looking at the screen on the left Then, he moves his head back to a central position; looks at students; hands join together in a central position as well; left elbow rests again on table screen	Looking to the right (system detected)
55	*And …*	Long *And* + Silence, while looking down …	

In the short fragment that illustrates example 4, the lecturer is not actually contributing any new idea or example to his transmission of content to the students. In fact, this is a clear example of a transition fragment. He has just explained a nice example, showing how he feels about it, and then he is moving towards another idea that will try to reinforce his next statement—while confirming the previous example explained. As the lecturer later confirmed in the interview, his aim was to move towards that transition; he was looking for the next words to utter, and this was simply a link between expressions to reinforce the previous and main example in this excerpt analysed. The two emotions—short-term excitement and frustration—overlap, even at a low level, and mark the transition to a fairly relaxed position.

To get his audience's attention, he modifies his natural physical position through specific movements which allow the students to see the purpose of the lecturer: to end this transition and continue with the main idea expressed in this recording. This is what Cuddy (2015) implies when she states that presenters—while modifying their initial natural position—generate a new image among their audience, getting the audience's attention, something that is resolved by going back to their original position. Turning the head and body to a different position, and moving hands and arms in circles suggest a question or a doubt that is somewhat clarified by the lecturer coming back to his original position—head back to central position, hands together, left elbow resting on the table monitor.

TABLE 5. Analysis of a short-term excitement example (example 5 in figure 2)

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
61	*I am doing this*	Head tilt to right Hands separate each one to their side	

Timing (0-77 seconds)	Discourse (Verbatim)	Lecturer's non-verbal language	Additional comments
62-63	*just because my boss*	Left hand moves, palm inwards and open to the chest, reaching the chest when he says *my* Smile Look at the front	
64	*is telling me*	Left hand moves forward; palm up	Metaphorical movement (meaning *telling* but not *me*)

In example 5, another case of a high degree of ST excitement is shown, and the cause is similar to that observed in example 1. In this case, the lecturer's movements are used to try to exemplify the concept previously explained. Now, he changes the example into direct speech as if he was the employee doing something, that is, he utters the statement in first person. Although the example is new, he introduces this as a kind of inner voice in the head of the employee wondering whether he is making the right decision. So, it is at the time of touching his chest and saying *my boss* that the highest degree of ST excitement happens; the body language is supporting his direct implication in the example. At this point, his feelings are more explicitly shown and his level of excitement increases. It seems that his attempt to personalise the message, to become part of the session himself—despite not being a real case, but just an example—increases the level of excitement observed. As Tin (2009) demonstrated, concretising or personalising examples, among other techniques, seem to make lectures much more interesting for learners: this is something that we can also observe in our sample, reinforcing Tin's view on how exemplification helps lecturers to better contextualise and personalise their message, also increasing the exploration of ideas and disciplinary thinking.

4. Conclusion

This paper has tried to demonstrate a stepping-stone in MDA studies. Our main concern has been to show that a technological tool that describes emotions and which was initially conceived of for other scientific fields, can provide further support for MDA research results. This work has certainly provided evidence that the Emotiv EPOC system has potential as an analysis technique for future research in the field of MDA and academic discourse. The Emotiv EPOC system allows the detection of lecturers' reactions to different stimuli that result in variations in their behavior and body language, and this could be related to the level of students' understanding. The

study shows that aspects such as ST- and LT excitement, interest/boredom, meditation and frustration are objectively recorded by the system, which may allow, on the basis of the results of future, more in-depth analyses, professionals to reduce aspects of their behaviour that might be considered negative. The specific fragment analysed has shown certain notable outcomes only in regard to ST excitement and frustration. The examples selected reveal how the lecturer's experience and self-confidence likely helped him to overcome problems and control his emotions as well as his body language in an EMI context. We also found that ST excitement only increased when the lecturer was making an effort to create his discourse so that students can follow it or when he gave a personalised example and was moving his hands and arms in a more vigorous way. In contrast, relaxed body language movements were found to accompany the repetition of contents or examples, seemingly being so internalised by the lecturer that delivery of well-rehearsed content does not produce any change in his emotions. When using discourse such as transition expressions, no emotions were stressed, even though a slight movement in the lecturer's natural position served as an attention-gaining strategy. Thus, our study has provided evidence that by combining the usual MDA based on a recording and the objectivity of the Emotiv EPOC system enhances our scientific rigour as MDA researchers.

Nevertheless, our study does have some limitations. This report of our study should be taken as we present it, that is, as a pilot study analysing a short fragment from a single lecturer. We understand that our results should therefore be considered with caution and that the data requires further corroboration through longer recordings with a variety of practitioners.

One of the most interesting aspects of our work is to analyse whether a situation of potential social anxiety is limited to teaching in front of an audience or whether the fact of doing so in an EMI context has a determining influence. We would also like to know how those types of teaching may affect the use of some paralinguistic features. Thus, our research will continue by comparing whether there are any differences when lecturers use their mother tongue and when they do the same activity in a foreign language. In the same way that observation of other lecturers or self-observation by means of video-recording is a technique used in many EMI studies and training (e.g., Banks 2020; Fortanet-Gómez 2020), incorporating an electronic device such as the Emotiv EPOC system in order to expand the information obtained can also be of much help in improving EMI lecturing—or any other lecturing scenario—, regardless of the type of lecturing style chosen.

The role of students is another issue that may benefit from the support of technology. Future research could try to obtain information, and understanding, about the emotions students experience in classes when interaction is required—a situation that may cause some anxiety to some students. Probably the technological tool employed would need to be different from the one presented in this paper, but this research would be beneficial for any kind of teaching.

Additionally, we aim at creating a specific work path for the development of this type of study in linguistic-based fields, since thus far this type of research has generally been employed in other scientific areas (i.e., marketing, product design), and most times from a business perspective. In fact, and during the process of developing our initial piece of research, we have contacted companies that offer facial and body movement detection systems that we could use for our investigation, although in certain cases we have found companies to not be very interested in collaborating with university research projects, at least in our field of research. Nevertheless, our study paves the way for future research that could help define the kinds of meanings conveyed through embodied modes in MDA.[1]

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