Istanbul Journal of Innovation in Education
Volume 1 Issue 3 December, 2015 pp. 147-166

Reconsidering Gesture Space for Naturalistic Teaching Gesture Research

Can DENİZCİ*
Brahim AZAOUI**

ABSTRACT

The use of gesture space constitutes a crucial factor for teachers in terms of ensuring a clear view of their movements as visual clues to convey meaning properly. Although various studies deal with the delimitation of gesture space within experimental settings, the handling of the issue for natural classroom corpora is very rare. Based on the video recordings of three French classes, criteria were firstly determined in order to provide a 3D gesture space description for a speaker gesticulating in a standing position. Then, both methodological and pedagogical implications resulting from the qualitative analysis of gesture space were discussed. In this perspective, five methodological/pedagogical relevancies arise from the description of teachers' use of gesture space in naturalistic classroom settings: the decrease of amplitude within consecutive gestures, the necessity for promoting the upper gestural zones, the problems related to the description of gesture space from the profile view, the intervention of two hands in two different gesture spaces and the extension of the limbs to the backside of the body.

Keywords: Gesture space, gesture amplitude, gesture visibility, teaching gestures, French language teaching.

Eğitsel Devinim Araştırmalarında Devinimsel Alan Kavramının Gözden Geçirilmesi

ÖZ

Öğretmenlerin öğrencilere düzgün biçimde anlam aktarmak için görsel ipuçları olarak yararlandıkları el-kol devinimlerinin alanı/genliği, sınıf etkileşiminde önemli bir etmendir. Günümüze kadar gerçekleştirilen birçok araştırma, devinimsel alanı/genliği deneysel ortamlarda betimlemeye çalışmış olsa da, konu, gerçek sınıf çekimlerine dayanan bütünceler bağlamında ender olarak ele alınmıştır. Dolayısıyla, yabancı dil olarak verilen Fransızca derslerinin gerçek sınıf çekimlerine dayanan bu çalışmada, ilk olarak, ayakta ders veren bir öğretmenin devinimlerinin alanını üç boyutlu olarak betimleyebilmek

* PhD, Research Assistant, Istanbul University, Hasan Âli Yücel Faculty of Education, French Language Department, can.denizci@istanbul.edu.tr, candenizci1978@hotmail.com.
** PhD, Associate Professor, ESPE/Aix-Marseille University, CNRS, LPL UMR 7309, France, brahim.azaoui@univ-amu.fr.

için birtakım ölçütler belirlenmiştir. Ardından, devinimsel alanın nitel betimlenmesine ilişkin olarak hem yöntemsel, hem de eğitsel çıkarımlarda bulunulmuştur. Sonuç olarak, gerçek sınıf ortamlarında öğretmenlerin devinimsel alanı kullanmalarına bağlı beş adet yöntemsel/eğitsel belirginlik ortaya çıkmıştır: Ardışık devinimlerde genlik azalması, üst devinimsel alanların öne çıkarılmasının gerekliliği, devinimsel alanın yandan görüntülenmesine bağlı sorunlar, iki elin farklı devinimsel alanlarda devreye girmesi ve uzuvların gövdenin arkasına uzatılması.

Anahtar sözcükler: devinimsel alan, devinimsel genlik, devinimlerin görünürlüğü, eğitsel devinimler, yabancı dil olarak Fransızca öğretimi.

1. Theoretical Framework

1.1. Use of gesture space for pedagogical purposes

One of the research fields of co-speech gesture studies (Kendon, 2004) is related to the study of the role of gesturing in learning/teaching processes (Tellier, 2012). As a more particular focus point in relation with the content of this paper, various studies, either via experimental settings or ecological corpora handling the studied phenomenon in its natural and spontaneous context (Tellier, 2014), describe the gestures of foreign language teachers in classroom settings, where *transmission of information*, *classroom management* and *student assessment* appear to be the three main pedagogical functions assigned to teachers' gestures (Beattie, 1977; Ferrão-Tavares, 1985; Martina, 1991; Allen, 1999; Allen, 2000; Lazaraton, 2004; Tellier, 2006; Azaoui, 2014; Denizci, 2015). It is to be pointed out that the movements of hands and arms examined in the above-mentioned body of research constitute the so-called *co-speech gestures* which "occur only during speech, are synchronized with linguistic units, are parallel in semantic and pragmatic function to the synchronized linguistic units" (McNeill, 1985, p. 351), and where speech and gesture are considered as "parts of the same psychological structure" (McNeill, 1985, p. 353). Thus, in accordance with the *multimodality* (Colletta, 2005) of communication in classroom, teachers also organize their "transmission practices" (Cicurel, 2011, p. 156) around gestures, mimics, posture, etc. In that perspective, Tellier (2008, p. 42) proposes the use of the term "pedagogical gestures" to refer to the movements of hands and arms embodied with the purpose of "facilitating the access to meaning in foreign language". As for the use of gesture space, it gains importance in terms of visibility by emphasizing movements on the visual level to make communication more effective.

Besides, the use of gesture space is apt to present differences depending on individual and cultural contexts as examined by Efron in 1941. His results include the fact that the Italian speakers from South of Italy make more ample movements than the Jewish speakers from Eastern Europe (Tellier, 2006). Similarly, Müller (2001) shows that Spanish speakers produce bigger gestures than German speakers. Moreover, differences also emerge due to the instructional context. For example, the experimental study of Tellier and Stam (2012) shows that, when French language teacher candidates face non-native students, they perform bigger gestures than those executed in the setting with native students of French. Strategic adjustments occur in order to privilege peripheral gesture spaces to make gestures more visible to non-native interlocutors.

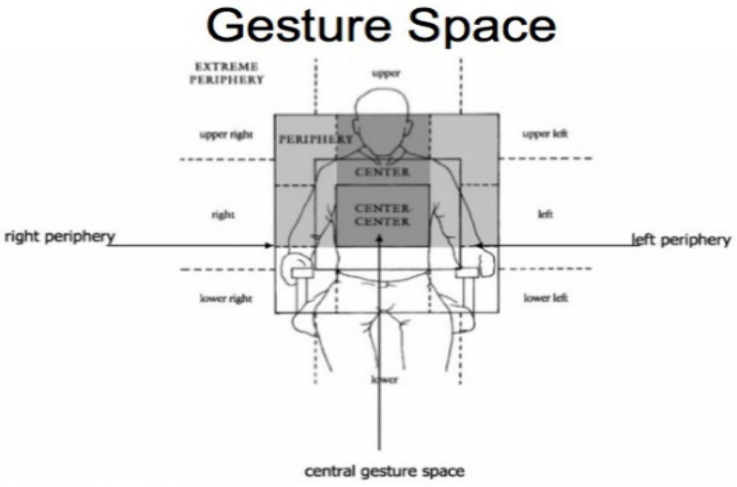
In the light of the above-mentioned points, the manipulation of gesture space is essential for teachers, in terms of reinforcing the understanding of verbal messages; i.e., as gestures constitute visual clues, teachers are responsible for ensuring the visibility of their movements.

The concept of *gesture space* comes into force just at this point. While conveying the information, pedagogical gestures can be executed within a gesture space big enough to provide a clear view perceivable even from the far end of a classroom (Tellier, 2006). Put in another way, teachers might adapt the size and the positioning of their gestures according to the *physical context* and to the *level* of students.

1.2. Delimitation of gesture space in the related literature

The essential typology concerning the gesture space is established by McNeill (1992, p. 89) who determines it with regard to the maximum amplitude reached by hand and arm movements in two dimensions, where four principal zones are distinguished, as shown via the figure below: "center-center", "center", "periphery" and "extreme periphery"[1].

Figure 1: Delimitation of gesture space according to McNeill



As we can see from the figure above (Fig. 1), the gesture space is organized around the center of gravity of a speaker in a seated position: thus, the *center-center* is located around the heart and extends from the level of the diaphragm to the upper part of the chest. The *center* comprises the zone between the hip and the chin in the frontal plane. The *periphery* is the zone above and below the center, and it extends from the chin to the forehead and from the hip to the knee. Finally, the *extreme periphery* covers all the reachable area outside the first three zones. This typology is based on two dimensions, and it does not take into account extensional and rotational movements executed respectively in the sagittal and the transversal planes.

[1] It should be noted that this typology is originally intended for an experimental narration task.

Apart from the above-mentioned typology, Müller (2001, p. 568) distinguishes "gestures which are performed at the level of the trunk and head" from "gestures which are performed above and beyond the head" in the frontal plane, and "gestures which are performed close to the body" from "gestures which are performed far away from the body" in the sagittal/transversal planes. Although her typology is three dimensional, the criteria regarding the detachment of the limbs from the body are rather simplified.

In their paper describing pointing gestures during a conversation happening between two speakers in a seated position, Tellier *et al.* (2011, p. 50) propose a category defined as the "arm extended forward" to circumvent the problem resulting from the appeal to two dimensions in McNeill's typology. On the one hand, their category seems to be incompatible with McNeill's categories from a taxonomic point of view, as it relates to a gestural morphology depiction formulated in terms of physical distance rather than a gestural zone. On the other hand, they do not clarify the detachment quantity of the limbs from the body; i.e., limbs are prone to being extended in different ways in different geometric planes.

In her research tackling the comparison of gestures accompanying verbal referents introduced for the first time in speech and those accompanying anaphoric referents during a narrative task, Foraker (2011, p. 284) comes up with a more precise solution by distinguishing "near-body" as the zone for gestures that are executed "between touching the body and extending the elbow out to 90°" from "far-body", where gestures "with the elbow extended past that point" occur.

Considering the related literature, one can realize that the gesture space is defined for seated positions. However, in classroom settings, teachers often gesticulate in a standing position, which leads us to put into question the applicability of McNeill's gesture space typology to instructional contexts. Furthermore, in general, gestures carried out in the transversal/sagittal planes are not described in a detailed way. Thus, an adaptation to classroom corpora seems necessary. This paper aims to propose a reviewed perspective of gesture space adapted to the specificity of naturalistic classroom settings. Firstly, the adopted methodology for delimiting gesture space in naturalistic classroom context will be mentioned. Then, the results obtained within the corpus in question will be presented.

2. Methodology

2.1. Study group and data collection

The participants of this study consist of 3 teachers giving French courses to non-native prep students in a private high school in Istanbul. The average age of the students is 14 and their language level corresponds to the A1 "breakthrough" level (Council of Europe, 2001, p. 23). The students' language ability being similar in the 3 classes, it was possible to have the instructors teach the same unit. Furthermore, assembling a total of 256 minutes of classroom video recordings, the data were collected through an empirical approach.

2.2. Transcription and method of analysis

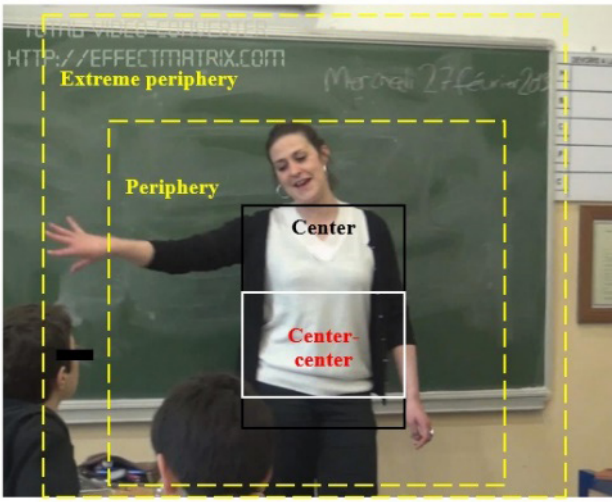
Teachers' speech was transcribed, and their gestures were coded/annotated according to their *dimension*, *function* and *space* on *ELAN* (Sloetjes & Wittenburg, 2008). Within the present paper, we will only focus on the annotations concerning gesture space. The implemented research strategy can be qualified as *qualitative*, which "emphasizes words rather than quantification in the collection and analysis of data" (Bryman, 2012, p. 36). More specifically, we applied the *ethnographic content analysis* consisting in the description/interpretation of a social phenomenon in its natural setting via pre-established initial categories which are prone to being reformulated or altered in the progression of the study (Altheide, 2004). In our case, the content analysis mostly relies upon the description of the *metalanguage* (Cicurel, 1985) brought into play by teachers' speech, as they talk about the foreign language in order to instruct. However, teachers' discourse also relates to classroom interactions and student assessment.

2.3. Criteria for annotating gesture space

Basing our coding on McNeill's (1992) typology and also benefitting from Foraker's (2011) angular extension idea, we determined certain criteria for coding gesture space for a speaker gesticulating in a standing position. As the center of gravity of the human body in a standing position is located near the navel, the surrounding zone was accepted as *center-*

center. Given that premise, gesture space can be delimited by following some visual clues: *geometric plans*, *distancing of the limbs from the body* and *angle formed between the upper and lower arms*. The essence of the delimitation lies in the fact that when the angle between the upper and lower arms increases, peripheral zones are privileged. On the contrary, when this angle diminishes, central zones gain importance. We tried to delimit the gestural zones arising from our methodological choices by the intermediary of the figure below (Fig. 2):

Figure 2: Adaptation of the gesture space for ecological classroom corpora



Hence, the gestures occurring at the *center-center* are those (a) which are performed below the chest and above the hip in the frontal plane, (b) which are limited by the left and right sides of the body in the frontal plane, including the arms, and (c) which take a maximum distance of one lower arm from the body in the sagittal/transversal planes (i.e., the angle between upper and lower arms is nearly 90° and the upper arm including the elbow touches or almost touches the lateral part of the body). As for the *center* zone, the gestures occurring in that space are those (a) which are performed between the chest and the chin *or* between the hip and the level of the reproductive organs in the frontal plane, (b) which are limited by the exterior side of the upper arm when it touches the lateral part of

the body in the frontal plane, and (c) which take a maximum distance of one lower arm from the body in the sagittal/transversal planes, where the elbow stays in touch or almost stays in touch with the lateral part of the body. For the *periphery* zone, the criteria are defined as follows: (a) either the gesture is performed between the chin and the superior part of the head or between the level of the reproductive organs and the knee in the frontal plane, although the angle between upper and lower arms is sometimes smaller than 90°, *or* (b) the angle between the upper and lower arms is obtuse (i.e., between 90° and 180°), *and* the arm moves away from the body towards any direction in the sagittal/transversal planes. Finally, the gestures performed with the arm completely extended out to 180° (or any angle close to 180°) and moving away from the body towards any direction belong to the zone called *extreme periphery*.

In the light of what has been said, examples corresponding to each gesture space can be given as follows:

Figure 3: Examples for each gesture space

2.4. Determination of gesture space in relation with gestural phases

Without going into detail, it should be specified that *gesture phases* help us organize a series of movements as a gesture. The "stroke" constitutes the essential phase giving its meaning to a gesture, where "the movement dynamics of 'effort' and 'shape' are manifested with greatest clarity" (Kendon, 2004, p. 112). Furthermore, the "preparation" is the phase leading to the stroke, while the phase called "hold" signifies the temporary suspension of the gesture in the air before and/or after the stroke, and the "recovery" phase signals the return to the resting position (Kendon, 2004, p. 112). The recovery phase is also called "retraction" by McNeill (1992, p. 25).

So, before proceeding to the analysis of gesture space in our corpus, it should be noted that the same gesture may travel several zones during its realization. That is why "the most ample point of the movement"[2] (Tellier *et al.*, 2011, p. 50) reached during any gestural phase can serve as a point of departure for annotating gesture space. However, such a criterion is also prone to being misunderstood, if one takes into account the retraction phase for example, where a gesture may reach its maximum amplitude. We argue that the most meaningful phases of a gesture correspond to the *end of the preparation* and especially to the *stroke*. As a result, the maximum amplitudes reached during these phases were taken into account.

Finally, for most of the cases, the positioning of the hand determines the annotation of the gesture space. Yet, in some cases, if fingers are more significant than the rest of the hand, the annotation was done by taking them into account (Tellier *et al.*, 2011).

3. Results

Considering the data collected through the video recordings of the French courses, five points are worth being discussed about gesture space: First of all, the cases of *consecutive gestures*, where gestures' amplitudes *decrease* from one gesture to the other will be examined. Secondly, problems of *visibility* will be discussed. Thirdly, when teachers position their bodies laterally with respect to students, the observation made *from*

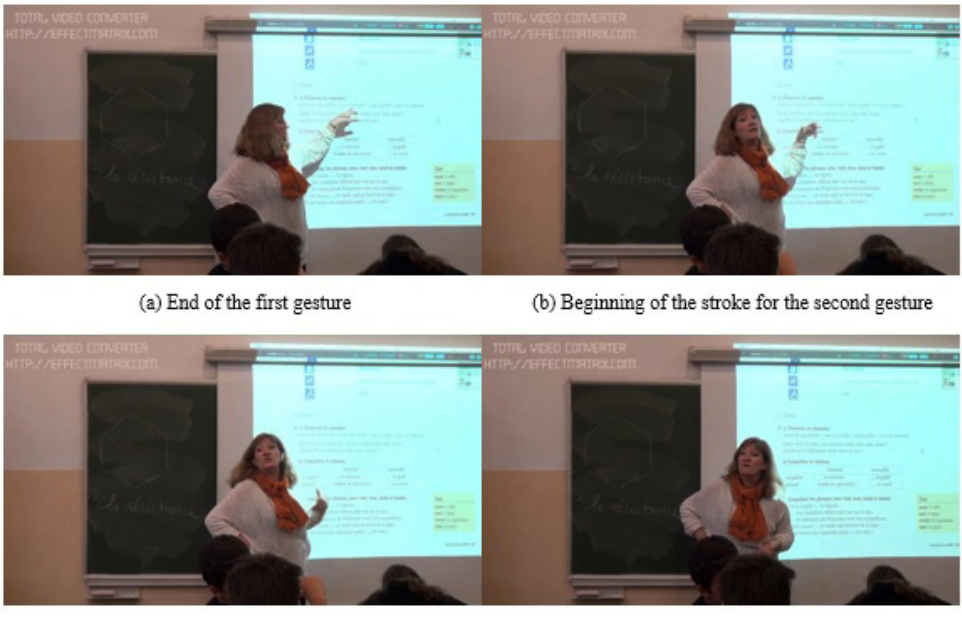
[2] "le point le plus ample du mouvement"

the profile view makes the annotation of gesture space difficult. Moreover, the situations where *two hands* intervene in *two different gesture spaces* are worth being analyzed. Lastly, hands and arms are sometimes extended out to the *back* of the body. Hence, the problems emerging from those circumstances should be methodologically solved. In some cases, pedagogical implications will also be discussed.

3.1. The decrease of amplitude within consecutive gestures

The occurrences where the amplitudes of the consecutive gestures decrease are important. In those cases, the annotation of the gesture space for the second gesture should not be conditioned by that of the first gesture from our point of view. As shown in the figure below (Fig. 4), the communicative situation concerns the teaching of the plural form of the possessive adjective 'our' (corresponding to 'nos' in French).

Figure 4: The decrease of amplitude for consecutive gestures



(a) End of the first gesture

(b) Beginning of the stroke for the second gesture

(c) Continuation of the stroke for the second gesture

(d) End of the stroke

First, the teacher points the middle finger of her left hand towards the board in order to ask the students the nature of the word ‘our’ (frame (a)). The extreme periphery is the gesture space of the first gesture. After the deictic gesture, her verbal answer ‘it is a possessive adjective’ (‘c’est un adjectif possessif’ in French) is accompanied with a metaphoric gesture performed with the same hand. This gesture travels through four zones from the extreme periphery to the periphery, next to the center before finally ending at the center-center zone. (frames (b), (c) and (d)). In consequence, although the second gesture passes through the periphery and the center, the corresponding annotation was carried out by taking into account the zone reached at the *end* of the stroke. In sum, the *center-center* was annotated for the second gesture. Thus, concerning the consecutive gestures, the gesture space annotation of the second gesture is *not* shaped by that of the first gesture. Furthermore, in those circumstances where the amplitude decreases, the zone reached at the end of the stroke is more important than that travelled during the preparation or the stroke.

3.2. Promoting the upper part of the gestural zone in classroom

As it has already been mentioned, providing a good gestural view to students seems necessary during the teaching process. If we consider the physical reality of a classroom, we can suppose that teachers might privilege the gestural zones figuring *above the hip*, so that even the students sitting in the back rows can see their gestures. Otherwise, if teachers’ use of gesture space causes visibility problems, the meaning is not conveyed properly except for the students sitting in the front rows. The figure below (Fig. 5) illustrates an example of that kind of problem.

Figure 5: Visibility problem

(a) End of the first gesture (b) End of the preparation for the second gesture

(c) Beginning of the stroke of the second gesture (d) End of the stroke of the second gesture

Here, the teacher firstly shows a word (‘plonger’ meaning ‘to dive’) on the board (frame (a)). Secondly, she illustrates the verb ‘to dive’ thanks to an iconic gesture with the right hand which moves first upwards (frame (b)) for coming then downwards to explain the act of diving (frame (c)). At the end of the stroke, the second gesture reaches the extreme periphery because the arm is completely extended and is detached from the body in the frontal plane (frame (d)). Therefore, the *extreme periphery* is the corresponding gesture space. However, the use of peripheral zones does not always guarantee the visibility of gestures, especially for the students sitting in the back rows. For this case, the end of the stroke is as important as the preparation phase in order to convey the meaning of the verb and to transmit therefore lexical information. As the lower part of the gestural space below the hip is used at the end of the stroke, the visibility is impeded to some extent. Consequently, from a pedagogical point of view, teachers might pay attention to promote the *upper* parts of the gestural zone in the frontal plane.

3.3. Observation from the profile view

There are lots of occurrences in our corpus, where teachers laterally position their bodies with respect to students. In those cases, they are generally focused on an element featuring on the board. Hence, the annotation of the gesture space becomes difficult, as it is not always possible to grasp the quantity of the arm's detachment from the body in the frontal plane.

Figure 6: Lateral positioning of the body

As we can see from the figure above (Fig. 6), the teacher shows a word written on the board with her left hand. She laterally positions her body. From a methodological point of view, the annotation of the corresponding gesture space is problematic due to the fact that it is not easy to understand the positioning of her left hand with respect to her trunk because of the side view framing; i.e., the gesture is located either at the center or at the periphery in the frontal plane. To remedy this kind of problem, more cameras are required in order to capture teachers' gestures from both the left and right sides. However, this solution would make the analysis of the data on ELAN more difficult because of the necessity about working on different images every time a teacher changes position.

3.4. Intervention of two hands in two different gesture spaces

A gesture performed with two hands is a gesture "where the hands move together"[3] (Tellier *et al.*, 2012, p. 48). There are two possibilities concerning the *two-handedness*: either the same pedagogical function is fulfilled with both hands having more or less the same gestural dimension, or two hands corresponding to two different dimensions assume two different but complementary functions (Azaoui, 2015). For the first case, the illustration of a word with two hands performing both a part of the same gesture can be given as an example (Fig. 7).

Figure 7: Same gesture, yet different gesture spaces

Here the teacher asks the students to do the following exercise 'in pairs' ('par deux' in French). She illustrates 'in pairs' via an iconic gesture, where the index fingers of each hand symbolizes each student. Hence, both hands contribute to the accomplishment of the same pedagogical function; i.e., information within activity management. However, the gestures of each hand are performed in different gesture spaces; the left hand at the center and the right hand at the center-center. In these cases, the most peripheral zone was annotated, supposing that it is prone to attracting more attention. Therefore, the *center* was chosen to be annotated. Concerning this kind of gesticulation, we should also make certain that if one of the hands is

[3] "où les mains sont en mouvement ensemble"

more significant than the other in terms of conveying the meaning, its gestural space can be annotated, even though it is less peripheral. In that perspective, the annotation may vary according to the specificity of each communicative situation.

Moreover, the annotation of the second type of two-handedness proves to be more complicated from a methodological perspective. As shown in the figure below (Fig. 8), the teacher tries to attract the attention of the students towards a fill-in-the blank type of exercise via a pointing gesture performed with the left hand.

Figure 8: Different gestures performed at different spaces

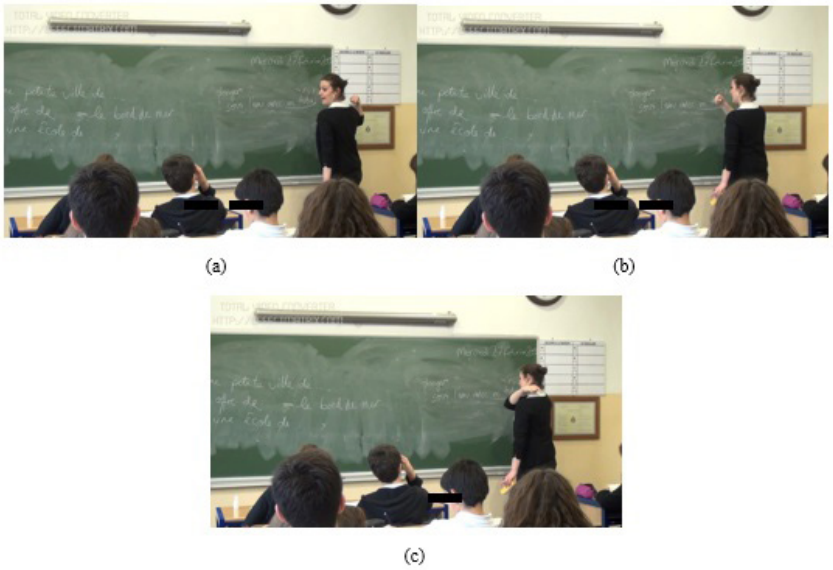
She shows in fact the words and the groups of words with which students carry out the exercise. At the same time, she asks them 'which vocabulary' ('quel vocabulaire' in French) is permitted to complete the exercise. Her speech is then accompanied with a metaphoric gesture performed by the right hand. Moreover, the deictic gesture is first executed and while it is being held, the metaphoric one intervenes. To sum up, the first gesture serves to attract the attention of the students towards the vocabulary and to keep them focused on it, while the second gesture accompanies the

question. Hence, the deictic gesture is performed at the periphery and the metaphoric gesture at the center-center. For a corpus of such duration, segmenting and annotating different hands on different tiers on ELAN complicate the statistical analysis. That is why instead of assigning a tier to each gesture, whenever two different gestures overlap, it is possible to annotate the gesture space of the newly introduced gesture considered as the most significant one according to the pedagogical intention. In the above-mentioned case, when the metaphoric gesture is performed, the corresponding gesture space can be annotated thus as *center-center*. Yet, according to the problematic of the research and the size of the corpus, one could also prefer to annotate two tiers belonging to two different gestures.

3.5. Gestures extended out to the backside of the body

In some circumstances, teachers extend their limbs out to the backside of the body. In such cases, the backside of the body can be considered as the front side, and the annotation of the gesture space can be done correspondingly. In fact, as shown in the figure below (Fig. 9), in order to properly convey meaning, teachers change their posture by turning their back to the students for making the backside visible.

Figure 9: Gesture space annotation for the backside of the body



In the present situation, the teacher asks the students with the aid of which gear it is possible to make underwater diving. Then, without taking an answer to her question, she first pronounces the verbal referent 'snorkel' and illustrates it with an iconic gesture, which is not shown above. Afterwards, she says 'or with the…' ('ou alors avec des…' in French) and refers to the 'air tanks' ('bouteilles' in French) without however verbally expressing the lexical item. Her utterance is accompanied with two abstract deictic gestures pointing towards two imaginary tanks attached to the back. Thus, the main pedagogical goal consists in giving lexical information so that students can express the corresponding lexical item in case they know it. That being said, she first turns her back to the students and points her right hand towards her right shoulder (frame (a)). Then, by passing through the front side of her body (frame (b)), the same hand points towards the back of her left shoulder (frame (c)). If we think of the backside of her body as if it was the front, the gesture spaces of both deictic gestures can be annotated as *periphery*.

4. Conclusion

In brief, in this paper we tried to adapt the delimitation of gesture space to natural classroom corpora, where teachers usually gesticulate in a standing position. Thus, criteria for annotating gesture space in a three dimensional approach were proposed. Furthermore, the necessity for considering the preparation and the stroke as the most significant phases was emphasized in relation with the maximum amplitude attained by a gesture. In turn, the amplitude helps us to code a certain zone as the space of a gesture. The analysis of the data highlighted five points which were explored both methodologically and pedagogically. Firstly, the cases where the amplitudes of gestures decrease pose methodological problems. We tried to solve these problems by considering each gesture separately. Secondly, although some gestures are performed at peripheral zones, a clear view is sometimes impossible except if the gesture is executed above the hip. Therefore, we stood up for the promoting of the upper parts of the gestural zone during classroom interactions so that meaning could be conveyed properly. On the other hand, when teachers laterally position their bodies, the determination of gesture space becomes difficult. In order to deal with that problem, more cameras seem necessary. Moreover, gestures are

capable of fulfilling different communicative/pedagogical functions at a given time. In those cases, if two hands contribute to the formation of the same gesture, the gesture space of the most peripheral or the most significant hand can be annotated according to the communicative situation. If two gestures overlap at a given time, the newly introduced one can be considered as the most significant gesture and the annotation can be made accordingly. Lastly, when limbs are extended out to the backside of the body, the corresponding gesture space can be determined by temporarily supposing the backside as the front side of the body.

To conclude, our adaptation is not intended to be mathematically precise. To make it even more accurate, motion sensors could be attached to the body of a speaker and it could be possible to transfer data to sophisticated computer programs to obtain more precise data about the determination of gesture space (Priesters & Mittelberg, 2013). However, this implementation might obstruct the spontaneity of the gesticulation brought into play by teachers in natural classroom settings. Lastly, the use of more than one camera could be effective in terms of diversifying the angle of framing, especially when teachers' gestures are seen from the profile view.

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