

Graduate Students and the Art of Public Speaking

Sven Maerivoet[†] and Bart De Moor[†]

September 2005

Paper submitted for publication in
*International Journal of Mathematical Education
in Science and Technology*

This report is available by anonymous ftp from <ftp.esat.kuleuven.ac.be> in the directory
<pub/sista/smaerivo/reports/paper-04-206.pdf>

[†]Katholieke Universiteit Leuven

Department of Electrical Engineering ESAT-SCD (SISTA)

Kasteelpark Arenberg 10, 3001 Leuven, Belgium

Phone: (+32) (0) 16 32 86 64 Fax: (+32) (0) 16 32 19 70

E-mail: {[sven.maerivoet](mailto:sven.maerivoet@esat.kuleuven.be),[bart.demoor](mailto:bart.demoor@esat.kuleuven.be)}@esat.kuleuven.be

WWW: <http://www.esat.kuleuven.be/scd>

Our research is supported by: **Research Council KUL**: GOA AMBioRICS, several PhD/postdoc & fellow grants,

Flemish Government: FWO: PhD/postdoc grants, projects, G.0407.02 (support vector machines), G.0197.02 (power islands), G.0141.03 (identification and cryptography), G.0491.03 (control for intensive care glycemia), G.0120.03 (QIT), G.0452.04 (new quantum algorithms), G.0499.04 (statistics), G.0211.05 (Nonlinear), research communities (ICCoS, ANMMM, MLDM),

IWT: PhD Grants, GBOU (McKnow),

Belgian Federal Science Policy Office: IUAP P5/22 ('Dynamical Systems and Control: Computation, Identification and Modelling', 2002-2006), PODO-II (CP/40: TMS and Sustainability),

EU: FP5-Quprodis, ERNSI,

Contract Research/agreements: ISMC/IPCOS, Data4s, TML, Elia, LMS, Mastercard.

Please use the following Bib_TE_X entry when referring to this document:

```
@techreport{MAERIVOET:05,  
  author      = "Sven Maerivoet and Bart De Moor",  
  title       = "Graduate Students and the Art of Public Speaking",  
  institution = "Katholieke Universiteit Leuven",  
  number      = "04-206",  
  year        = "2005",  
  month       = sept  
}
```

Graduate students and the art of public speaking

SVEN MAERIVOET and BART DE MOOR

Department of Electrical Engineering ESAT-SCD (SISTA)
Katholieke Universiteit Leuven
Kasteelpark Arenberg 10, 3001 Leuven, Belgium
Phone: +32 (0) 16 32 17 09 Fax: +32 (0) 16 32 19 70
URL: <http://www.esat.kuleuven.be/scd>
E-mail: {sven.maerivoet,bart.demoor}@esat.kuleuven.be

(Received: September 2005)

There exists an unrealistic balance between academic speaking and academic writing: papers can get rejected, whereas speeches are not. As such, bad presentations are more than often a waste of time. In this paper, we present the results of a case study that investigated the behavioural aspects that govern graduate students (in the engineering and mathematical sciences) during presentations given at seminars and conferences. We consider a 'tool' that comprises a first step towards assessing oratory skills in an academic environment. As the main result of our interdisciplinary research, this tool is then used to extract three typical behavioural patterns from the sample population of graduate students. A second part of the paper focusses on the oral aspects of giving an excellent presentation (using visuals such as electronic slides and/or plain transparencies), complementing it with some of the key aspects we believe are a necessity for achieving an acceptable level. Together, these three basic principles can be summarised as follows: always keep in touch with the audience, visual clarity is mandatory, and slides should only contain relevant content.

Keywords: graduate students, academic oratory skills, presentation style

1 Introduction

It happens all the time: we are sitting amongst an audience, listening to yet another boring speaker that is giving a bad presentation. When this happens, i.e., the presentation is below a certain minimum quality threshold, people get rather annoyed. As it's important to know as to what exactly is giving an audience this feeling, we performed a case study, that sheds some light on the behavioural aspects that are related to speakers during a

presentation. These aspects include body language, dealing with questions from and reactions of the audience, the tone of voice, and a speaker's sense of timing. Our paper relays the results of an empirical experiment, based on a group of 27 graduate students in the engineering and mathematical sciences. To the authors' knowledge, there exists no previous research regarding this subject. Therefore, the goal of the study was to provide and evaluate a means for assessing the form and manner of these students' academic scholarly presentational skills, mainly observed at graduate seminars and conferences.

The first part of this paper, section 2, gives a detailed account of our case study [1] that investigated the oratory skills of a sample of graduate students (i.e., assessing their performance at mastering an original and persuasive speech). The focus here lies initially on the context of the scientific study, i.e., the choice for graduate students with their respective background, and where and how the case study was performed. We then describe how we developed and applied our experimental methodology, after which we give an interpretation of the obtained results. Whereas the research elucidated in this first part deals with people's general behaviour at speaking, the second part of our paper, section 3, focusses on the oral aspects of giving an excellent presentation (using visuals), complementing it with some of the key aspects we believe are a necessity for achieving an acceptable level. Our paper concludes in section 4, where we provide a discussion and summary of our findings, as well as some pointers to future research.

Clarification: for the sake of textual clarity, we refer to a speaker in the masculin form. But note that the feminin form is implicitly considered.

2 An investigation into academic oratory skills

In this section, we first highlight the context of the scientific study, i.e., why we choose graduate students with their respective background in engineering and mathematics, and where and how we performed the case study. Subsequently, this leads us to a rigorous problem statement, after which we are able to give a detailed account of the development and application of our experimental methodology. In conclusion, we reflect on our research, give an interpretation of the obtained results, and state the importance of oratory skills.

2.1 *Context of the scientific study*

Considering the background of the sample population for our case study, we explicitly choose to work with graduate students in engineering and mathe-

matics. The choice for graduate students stems from the fact that at most seminars and conferences, it is exactly this group of people that is presenting research results towards a broad audience. The main reason behind the choice for picking graduate students from the engineering and mathematical sciences, is because we feel that many of them seem to focus more on the mathematical content than on the delivery of a good presentation. Despite the general perception that presentation style in seminars given by these graduate students is important, we frequently observe that the quality of delivery tends to be neglected. As a matter of fact, in many curricula of the exact and applied sciences there seems to be a lack of courses that train these presentational skills, a view that is often expressed by both undergraduate students and their tutors. This is especially true in this case, as opposed to the humane sciences where it is plausible to assume that graduate students in the programmes of rhetoric and speech already have had this training as one or more basic courses in their scholarly curriculum. A further point of information that needs to be taken into account, is that most of the graduate students in our case study are non-native speakers (with respect to the internationally adopted English language). For two thirds of the sample population, Dutch was the native tongue.

Our case study was based on a sample of 27 graduate students that were observed at seminars and conferences attended at various locations such as the departments of both “*Computer Science*” and “*Electrical Engineering*” at the Katholieke Universiteit Leuven (Belgium), the “*Benelux Meeting on Systems and Control*” 2003 in Lommel (Belgium), and the 15th Belgium-Netherlands “*Conference on Artificial Intelligence*” 2003 in Nijmegen (The Netherlands). All these presentations approximately lasted between 20 en 30 minutes, with audiences ranging from 10 to some 50 people (the speakers and their audiences shared the same professional backgrounds).

Consequently, we can state that the motivation behind our research mainly stems from the fact that an acceptable presentation style is often lacking. This leads directly to irritation among the audience, resulting in people getting frustrated, falling asleep, feeling alienated, . . . One of the most striking observations we made, was the fact that a lot of people bring along some reading material (e.g., papers and even laptops). This is a clear indication that an audience sometimes gets the feeling the speaker is literally wasting their time. As such, the reason for an audience’s behaviour, often finds its seeds in many of the following shortcomings:

- there is a misuse (sometimes even an abuse) of the English language,
- people use an annoying body language (they are either too stiff, or too vibrant),

- sometimes the speaker seems to be afraid of the audience,
- or the speaker is too arrogant, or too audacious.

In order to set the scene correctly and to avoid confusion with respect to nomenclature, we give some definitions of the terminology used throughout this paper [2]:

- *Rhetoric*: the art of using language effectively in speech or writing, especially in order to influence or persuade one's audience.
- *Oratory*: the art of public speaking.
 - *Eloquence*: the ability to impress or persuade by skill in writing or speaking.
 - *Articulation*: the act of speaking clearly (on both levels of pronunciation and clarity).
 - *Persuasion*: the ability to convince.
- *Oration*: a formal, long speech, given on an important occasion. Sometimes also referred to as an unnecessarily formal or pompous speech (so oration can be considered as an 'application' of oratory).

To conclude, we can define the research problem that lies at the heart of our case study, by asking the following two questions:

- (i) How can we assess graduate students' oratory skills in an academic environment such as seminars and conferences ?
- (ii) Can we use this to determine what typical behavioural patterns exist among a sample of people at graduate seminars ?

In the remainder of this section, we will answer both questions and give an interpretation of our findings.

2.2 *Development and application of the experimental methodology*

Considering the previous two research questions, we now answer these in detail by explaining our methodology. We start with a description of how we collected the data for our experimental setup. After this aggregation step, we explain how to extract typical behavioural patterns from such as sample of graduate students. This latter step allows us gain insight into their observed behaviour by categorising them into distinct groups; the resulting characterisations make it possible to consider the main differences between speakers' performances.

2.2.1 *Assessing oratory skills (data collection)*.

Our method for assessing graduate students' oratory skills, is based on the perception of their performance. To this end, we looked at several possible behavioural

characteristics (from now on, we call them ‘categories’) that are of particular importance [3–6]. In order to objectively assess these categories, explicit descriptions are needed, allowing us to give a more precise ‘measure’ when evaluating the seminars. This leads us to a distinction between 12 different behavioural subcategories. All subcategories were listed on a *seminar evaluation sheet*, and these were filled in by one of the male authors of this paper and a female colleague.

On these sheets, each subcategory was evaluated using a scale, of which the end points are defined by its extremes, i.e., ‘the good side’ of a category versus ‘all its bad sides’. Initially we thought about using text labels to describe these scores; however, at a later stage we needed to be able to compare them mutually, thereby necessitating the need for quantified observations. As a result, each speaker at one of the 27 seminars received for each of the 12 subcategories a score between -100% and +100%:

- **Body language:**

- (1) *Style*: is the speaker very nervous and/or agitated, or is everything under control and does he handle a relaxed style ?
- (2) *Vividness*: does the speaker uses an irritating body language (i.e., too stiff or too vibrant), or is he doing the right thing at the right time ?

- **Answers:**

- (3) *Reaction to questions*: is the speaker hiding his ignorance, perhaps using evasive strategies, or is he giving fair and honest answers (e.g., ‘don’t know’) ?

- **Audience:**

- (4) *Contact*: does the speaker seems afraid of the audience, or does he maintains affinity (e.g., eye contact) ?
- (5) *Clarity*: is the subject brought too simple or too complex, or was it a clear and understandable talk on a reasonable level ?
- (6) *Control*: is the audience easily distracted (e.g., whispering, sleeping, reading, writing, . . .) or does the speaker holds the audience’s attention ?
- (7) *Prejudice*: does the audience seems prejudiced towards the speaker and/or subject, or is the speaker given ‘a fair chance’ ?

- **Voice:**

- (8) *Tone*: does the speaker has a demanding/boring/monotonic voice, or is it an interesting listening experience ?
- (9) *Coherence*: does the speaker makes a constant use of fillers (e.g., ‘Euhm’, ‘Well’, ‘You know’, . . .) or is it a coherent, fluid talk ?
- (10) *Pausing*: are there too little or too much silences, hesitations, or small pauses, or does the speaker uses strategically timed pauses between fluid talking ?

- (11) *English*: are we listening to a poor use of the English language, or is the speaker talking in excellent English (non-native) ?
- **Timing**:
 - (12) *Planning*: is the speaker over time or on time with his talk and questions ?

Note that we weighted each of these 12 different subcategories individually, resulting in the following relative importance of the 5 major categories: body language accounts for 18%, answers for 11%, audience for 33%; voice for 33%, and timing for 5%. So the most important aspects are body language, audience, and voice. For reference, we have listed all obtained scores from the 27 evaluated graduate students in our case study in table A1 in appendix A.

2.2.2 Determining typical behavioural patterns (data mining). Having collected all the data from the 27 randomly picked graduate students, we can now answer the second research question, i.e., what typical behavioural patterns exist among such a sample ? Our method for dealing with this question, is by considering all students in the case study, and trying to classify them into groups that have a distinct behaviour. Translating this into a mathematical approach, the problem now becomes one of *clustering data*. In general, we can say that the goal of clustering is to (automatically) uncover a number of groups in data (i.e., the clusters), corresponding to previously hidden data structures. Within one group, all patterns should be ‘similar’, whereas they should be sufficiently different between groups [7].

Whereas we introduced the 12 different subcategories in order to allow a more feasible quantification of the observed speakers, we now recombine the individual scores into the 5 earlier mentioned categories (see section 2.2). The reason for this can be traced back to the fact that we only have a population of 27 students, which is actually too small for doing meaningful clustering on 12 subcategories. Hence the reduction to 5 categories.

The clustering itself was done using the *S-Plus 2000* software package [8], where we used the technique of *partitioning around medoids* (PAM). The PAM algorithm considers each of the 27 graduate students and tries to cluster them, such that students that have received similar scores will be grouped together [9, 10]. Mathematically, the PAM algorithm thus creates clusters in a five-dimensional space, out of a set of 27 data points. Before the PAM algorithm is ran, it needs to know the number of clusters sought after in the data. In other words, PAM requires us to specify the number of distinct groups containing graduate students with similar behaviour.

This is a typical problem encountered in data mining, as it corresponds to providing a clustering algorithm with a certain level of a-priori knowledge. As such, clustering can be a trial-and-error process, in some cases demanding extra iterations until the obtained results are deemed acceptable [7]. Our experimental setup showed that *three groups* was the optimal number. On the one hand, not enough detail can be distinguished when only requiring two groups. On the other hand, four or more groups introduce anomalies in which a group is formed by a single graduate student (i.e., the PAM algorithm considers this person as an outlier to the rest of the population).

After clustering all data points according to similar behaviour, three qualitatively different groups of graduate students can be distinguished. A representation of these three groups can be seen in figure 1. Note that in order to visualise these five-dimensional groups, we employed a mathematical technique called *principal component analysis* (PCA), that allows us to reduce the groups from five to two dimensions (termed PCA component #1 and PCA component #2) such that we can plot them in a two-dimensional graph [11]. Also note that as a result of the PAM algorithm, each group contains more or less the same number of people.

2.3 Interpretation of the obtained results

As explained before, condensing the sample population of 27 graduate students into groups using the PAM clustering algorithm, leads us to a catalogue of distinct behavioural patterns. In the following, we present some of the aspects of these typical patterns and compare them with existing literature.

In figure 2, we show the three resulting groups. As can be seen, groups #1, #2, and #3 contain respectively 8, 10, and 9 graduate students. The scores for each student are represented by a quintuple of bars, denoting the five main categories body language, answers, audience, voice, and timing. The number right next to each quintuple corresponds to the anonymous identification number of that graduate student in the case study (refer to table A1 in the appendix for a person's individual scores).

Looking at the first group (i.e., the top line in figure 2), we notice that all scores seem to be alternating, indicating students with the worst performance. In the second group (i.e., the middle line in figure 2), the majority of the obtained scores is positive, with a few exceptions. There exists however a significant variability between the different scores, indicating students with a mediocre performance. And finally, in the third group (i.e., the bottom

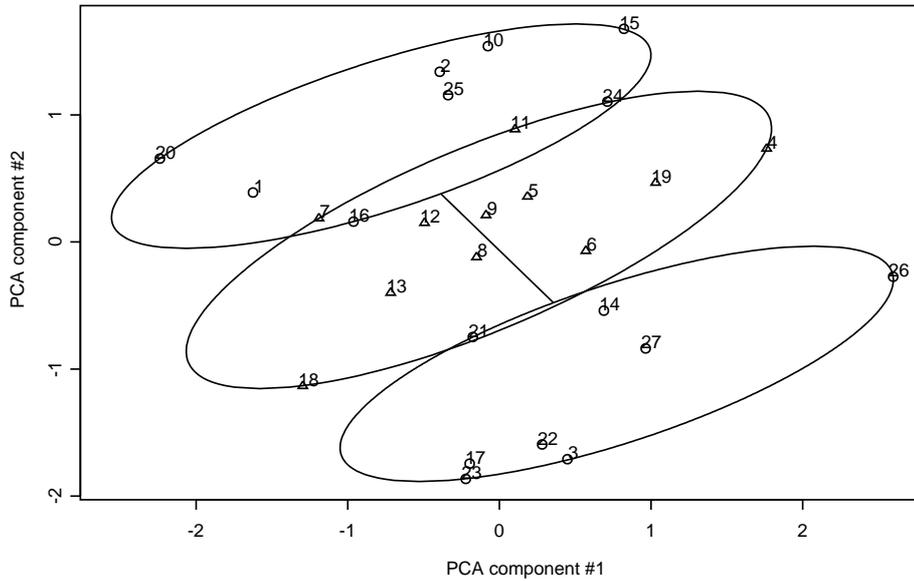


Figure 1. A graphical depiction of the three groups found by the PAM algorithm. For visual clarity, we reduced the five-dimensional space to two dimensions, resulting in a more intuitive feeling for the groups as they can now be plotted in a two-dimensional graph. The numbers alongside each data point correspond to the anonymous identification numbers of the graduate students in the case study (refer to table A1 in the appendix for a person's individual scores).

line in figure 2), almost exclusively high positive scores exist (with only two small exceptions for persons 3 and 26), indicating students with the best performance.

For a better characterisation of the different groups of speaker's behaviour, we compute what an *average graduate student* in each group looks like. Figure 3 provides us with the average scores for each category in each group. Our findings are summarised in table 1. It can clearly be seen that groups #2 and #3 are related in that they have all positive scores, whereas group #1 contains mostly zero or negative scores. This means that in group #1, students have a bad body language, deal more or less sufficiently good with their audience, but speak with a rather demanding voice. In contrast, students in groups #2 and #3 behave much better, adopting an engaging body language, dealing very well with their audience, and speaking with a interesting/professional voice. Also note that timing and dealing with answers are approximately the same for all three groups.

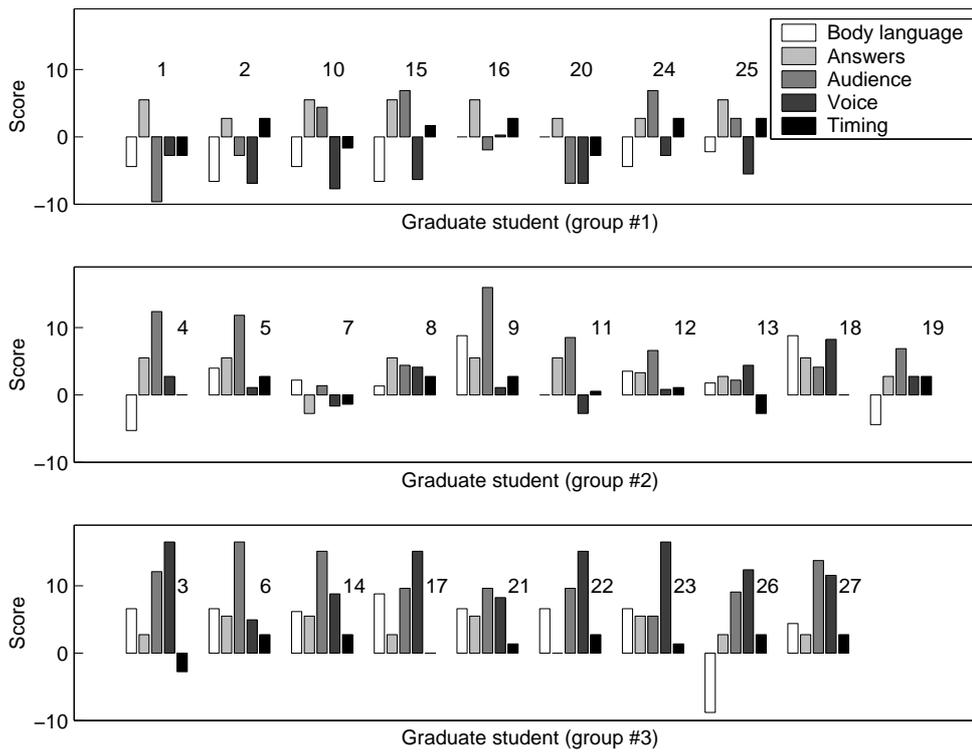


Figure 2. The three resulting groups after running the PAM algorithm. Each quintuple of bars corresponds to one graduate student; the consecutive bars within such a quintuple denote the body language, answers, audience, voice, and timing behavioural categories, respectively. The numbers alongside each data point correspond to the anonymous identification numbers of the graduate students in the case study (refer to table A1 in the appendix for a person's individual scores). As can be seen from the graph, the first group (top line) is characterised by having alternating scores, indicating students with the worst performance. In contrast to this, the majority of the obtained scores in the second and third groups (middle and top lines, respectively) are positive, with a few exceptions. They indicate students with mediocre and best performance, respectively.

Table 1. A summary of the behavioural characteristics for each of the three groups: -, +, and ++ indicate bad, mediocre, and best performance, respectively.

Category	Group #1	Group #2	Group #3
<i>Body language (BL)</i>	-	+	++
<i>Answers (AN)</i>	+	+	+
<i>Audience (AU)</i>	-	+	++
<i>Voice (VO)</i>	-	+	++
<i>Timing (TI)</i>	-	+	++

2.4 Conclusions

As we compared our findings to those in literature, we discovered that the latter is surprisingly silent about relations among the different behavioural subcategories. An example of this is the fact that we discovered that a

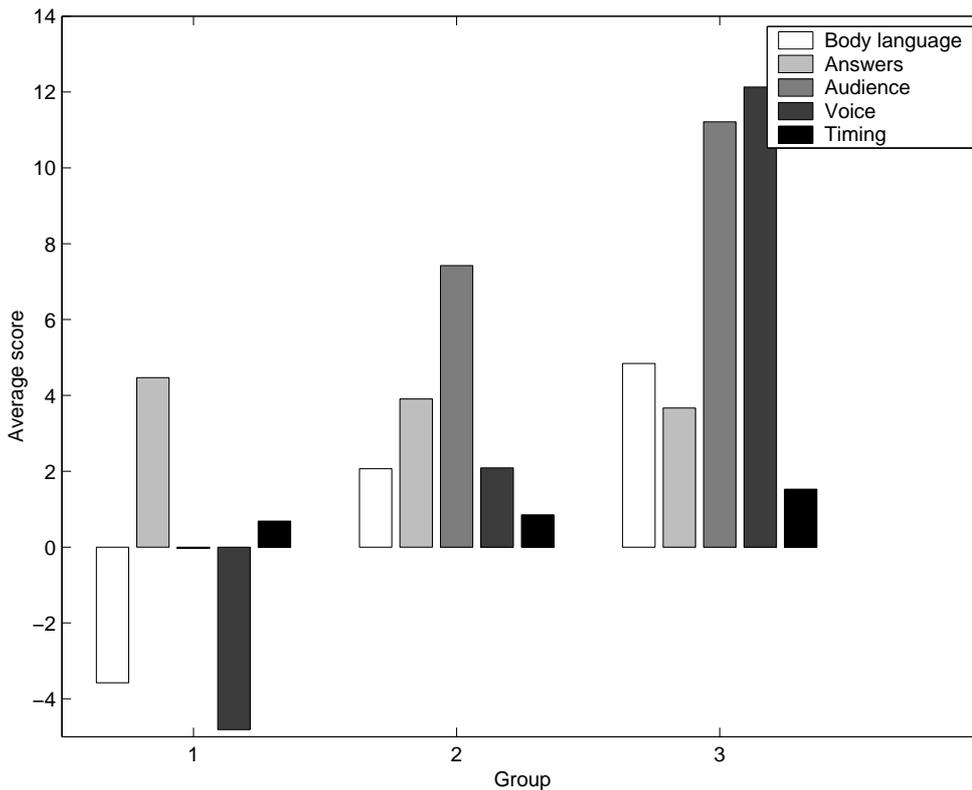


Figure 3. An average graduate student in groups #1 (left), #2 (middle), and #3 (right). Consecutive bars within each quintuple denote the body language, answers, audience, voice, and timing behavioural categories, respectively. Note the especially worse performance with respect to body language (BL) and voice (VO) for students in group #1. In contrast to this, students in groups #2 and #3 have all behavioural categories rather positive. Note that this latter group performs exceptionally well at all behavioural categories (except timing (TI) which only accounts for 5%), as opposed to the more mediocre results of group #2.

suitable body language and voice result in a gripped audience. An exception to this rule however is our finding that timing is largely independent for all three groups, which seems to agree with most literature where it is stated that a speaker loses all his sense of timing. And judging from the performance of the sample population at the answers subcategory, we note that it is more or less the same for all groups. This raises an interesting point, i.e., the difficulty in deciding whether or not a speaker is hiding his ignorance or is cleverly using evasive strategies (a phenomenon that typically occurs among politicians).

It should be noted that initially, our case study was targeted towards question-and-answer (Q&A) sessions. But due to the literature's conciseness, we developed our own methodology (i.e., evaluating graduate seminars), in

which this Q&A is implicitly present, but of minor importance. It seems that when people are forced out of their comfortable shell/position, they may lose control of the situation. Some examples of this phenomenon are:

- sometimes a speaker is interrupted during his presentation,
- or a speaker is deprived of answering a question, in which case the audience, a senior researcher (e.g., a professor), . . . answers,
- a speaker can be confronted by a barrage of questions,
- or the audience starts discussing among itself.

So there exists a difference between the ‘closed’ and ‘open’ parts of a presentation: the former can be prepared thoroughly (i.e., the speaker *should be* in control), whereas the latter requires more improvisation (i.e., the audience *may be* in control).

3 Giving an excellent presentation

Whereas the previous section dealt with people’s general behaviour at speaking, this second part of our paper presents some of the key aspects we believe are necessary in order to give an excellent presentation. In our opinion, such a presentation hinges on the following three important aspects:

- an fluid oral presentation (section 3.1),
- a good visual layout (section 3.2),
- and a relevant content (section 3.3).

These three aspects are clearly aimed at presentations that are based on visuals using slides (be they electronic or plain transparencies). Inspired by our observations and results obtained in the previous section, we start with some commentaries on the oral part of a presentation. Note that another approach was recently followed by Movshovitz-Hadar and Hazzan, in which they derived a set of principles for giving a good presentation, based on the analysis of a highly successful lecture given by a teaching award winning professor of mathematics [12].

3.1 Giving a fluid oral presentation

Once a speaker has created and finished his bundle of slides, all the focus goes to the most important aspect of all: *giving an astonishingly good oral talk*.

Always keep in touch with the audience !

Not all speakers are aware of the fact that giving a presentation implicitly assumes entering a *dialogue* with the audience (by which we assume a different connotation than with traditional Q&A sessions), and this facet should not be neglected nor underestimated. Some advice:

- First things first: welcome the audience, and perhaps quickly thank the organisation (although this particular custom is fading). Then give a short speaker introduction, after which the talk should just... start !

Do not take minutes long to give a lengthy introduction to the talk, because this is a waste of the speaker's and the audience's time ! When talking for 20 minutes, it's rather pointless to give an introduction of 5 minutes (although there are some people that dare to do this from time to time).

- Correspondingly, when the end of the talk is near, the speaker should wrap it up concisely; here is his one and only opportunity to give the audience some final statements before they leave and forget about the talk. So a speaker should do his best to make it stick to them !
- Do not speak too fast or too slow; take time to let the audience absorb the words.
- Do not use words that the majority in the audience does not understand, unless when they are carefully explained to them. This is *especially* true for field terminology; a speaker should not assume that everybody knows and has the same information as he. And although this seems obvious, many talks are not tailored to the audience's background. Our advice is that one should assume that the audience knows much less about the subject than the speaker itself. People do appreciate a simple, i.e., easy to follow, presentation.
- Always maintain contact with the audience, feel their perception of the talk. If this is not done, a speaker gets disconnected from his audience. There does exist a connection between a presenter and his audience (cfr. the earlier mentioned 'dialogue'), and a speaker must be aware of this link.
- Pay attention to the tone of voice; do not always use the same vocal pattern for every sentence. Especially avoid toning down at the end of a sentence ! With respect to the filler word 'euhm', we sustain its use, but as always, do not overdo it. So talk lively and spontaneously, avoid being boring because this can be considered as a form of disrespect towards the audience.
- Never, never, never read slides literally. There are those ignorant speakers, that show a slide (which contains some nasty long sentences), talk a bit about this slide, and then read every sentence aloud, word by word. This is an annoying, irritating, and pointless habit. Speaking time is limited, so make good use of it: the audience has already read the slide, so give them something new to remember.

Note that a card (or even a clear complete page) containing some key words is allowed, but do not write any full sentences on this card, because then there is the temptation to read them aloud.

- Always respect the assigned time slot; speaking for a too short amount of time is unprofessional, but speaking for too long is unacceptable (if a speaker is not confident enough, he should practise his talk beforehand). There is no respect for late runners ! Keep in mind to include time for questions et cetera.

Regarding this aspect, we should mention that there are two schools of thought:

- extensively practising a talk is a necessity,
- never totally practise a talk, but just dive in.

We believe that neither of them is correct, but a mixture is fine: when starting a presentation, it's normal to feel nervous. But once talking, this nervousness should fade away, making place for a strong confidence. If having to practice a talk in order to gain this level of confidence seems needed, then by all means please do ! But in the end, do not sound like a robot (which corresponds to our earlier statement that a talk should be lively and spontaneously).

3.2 *Providing a good visual layout*

The speaker should always keep this one in the back of his mind: when speaking, the audience is looking at his slides. But note that they are either fully listening to what he is saying, or they are looking at and reading his slides. A good blending of both aspects is a necessity, which leads to an important statement:

Visual clarity is mandatory !

So littering slides with lots of text should be avoided at all times, resulting in the following key tips:

- Avoid long sentences and long bulleted lists with many sentences,
- Avoid the overuse/abuse of fancy effects (especially those for which Microsoft's PowerPoint is particularly notorious), such as text that comes flying in from the right hand of the screen. If the use of an effect is wanted, then let the text just appear on the screen (e.g., fade in), but this should not be done for every line of text (which would be overkill) !
- Every slide should have the same stylistic layout, so beware for a 'zoo of

colours'. This means that the same colour palette should be used for all slides. Furthermore, the number of different fonts used in your presentation should be limited (our advice is to keep it at exactly one), and all slides should have the same textual layout.

Considering the use of **bold**, *italic*, and underlined text, we give the following advice for bulleted lists: do not look at which words should be stressed in each item, but look at the words that should be stressed in the *whole* list. This allows the audience to focus on the relevant aspects of a slide, keeping them away from further distraction. The other — non-stressed — words should only be there to guide the eyes and brain.

3.3 Focussing on relevant content

Whereas the previous remarks dealt with a fluid talk and the visual aspects, we now turn our attention towards the content of a good presentation. As a general guideline, we state the following:

Slides should only contain relevant content !

Although the above statement seems quite obvious, the principle is nevertheless violated all too often. Focus only on what should be conveyed, anything else can be considered as distracting material. The following pointers help along the way:

- Do not put too much information on one slide; this automatically excludes the use of items such as large tables and complicated figures (they can however be complex). Beware that there is a minimum font size below which any text is unreadable for a large part of the audience. Regarding tables and figures, we give the advice of showing only those features that are deemed relevant (e.g., some values in a table or figure can be put in bold).
- In many cases, an overview slide follows directly after the title slide. Be alert to keep this overview slide concise, i.e., do not give a fully complete table of contents (remember, a presentation is being given, not a written paper). So only highlight the main parts in a talk.
- The presentation should be chained together, so that going from one slide to another is a fluid process. Allow the audience to catch up regularly, because it is important for them to know where exactly the speaker is in his presentation.

4 Discussion and summary

Our discussion is split up in two separate parts: the first part considers the research done with respect to the case study in section 2, the second part discusses the presentation guidelines of section 3.

- *Academic oratory skills*

With respect to the first part of our paper, uncovering the behavioural aspects that govern speakers during presentations, we conclude that in fact PhD defences are better suited for doing Q&A research (which was in fact our initial goal). These defences are more worthwhile, as they generally generate a higher level of stress for the speaker. Nevertheless, our research provided a ‘tool’ that comprises a first step towards assessing oratory skills in an academic environment, with the extra benefit that it is largely language independent.

Furthermore, the fact that all groups contain more or less the same number of people due to the PAM clustering algorithm, should not be neglected. Indeed, a more ‘objective’ clustering algorithm would seem appropriate, in which the number of graduate students in different groups can vary. This would confirm the natural intuition that there are more average than excellent people (i.e., group #2 would contain the majority of the population). Further research in this direction should prove to be beneficial.

Related to the previous remark, a more objective approach towards the evaluations may seem desired, as they will always remain in the eye of the beholder. However, the authors believe that this has no significant effect on the final results, as they are quite stable because of the specific clustering method which is by itself already quite robust. Our method nicely extracts three groups portraying different behavioural characteristics. Still, using other categories is an unexplored avenue that can shed another light on the possible behavioural expressions that seem to govern speakers.

Finally, relating our results to the speakers’ individual backgrounds should be a next step in this research. All our evaluations were based on graduate students having their background in exact and applied sciences, i.e., more mathematically oriented disciplines. We know that writing mathematical research papers requires a completely different approach as opposed to writing research papers in the more socially and humanely inclined disciplines. And thus, the question remains whether or not the same holds true for seminars given in both scientific fields. We believe that

there certainly is a distinction to be made, and that further research should prove that both types of seminars will give distinct results with respect to behavioural patterns. In our view, this latter statement might introduce the need for considering other behavioural categories, depending on the scientific discipline in which the study is performed.

- *Presentation style*

In our opinion, there exist three basic principles that are a necessity for giving excellent presentations:

- Always keep in touch with the audience.
- Visual clarity is mandatory.
- Slides should only contain relevant content.

Note that we find it worthwhile for further research to focus on a similar evaluation as explained before in our case study, but this time with respect to the style of visual presentation. Based on these results, it is then possible to investigate whether or not there might be a connection between the quality of visual presentation and a speaker's oratory skills.

As a final conclusion to this report, we can also state that there is an unrealistic balance between academic speaking and academic writing. The fact of the matter is that papers can get rejected, whereas speeches are not. As there is no quality check regarding presentations, bad presentations more than often *are* a waste of time. There exist high requirements both language- and content-wise for textual material (e.g., publishing papers in journals), but in sharp contrast to this, the spoken word is not always respected as such

...

To end, let us cite Lehr [13]:

**“Let there be an end to
incredibly boring speakers !”**

Acknowledgements

S. Maerivoet wishes to thank Celine Vens for her cooperation during the research presented in [1], on which most of the material in section 2 is based. The authors also wish to thank two anonymous referees for useful insights and suggestions.

Dr. Bart De Moor is a full professor at the Katholieke Universiteit Leuven, Belgium. Our research is supported by: **Research Council KUL:**

GOA AMBioRICS, several PhD/postdoc & fellow grants, **Flemish Government: FWO**: PhD/postdoc grants, projects, G.0407.02 (support vector machines), G.0197.02 (power islands), G.0141.03 (identification and cryptography), G.0491.03 (control for intensive care glycemia), G.0120.03 (QIT), G.0452.04 (new quantum algorithms), G.0499.04 (statistics), G.0211.05 (Nonlinear), research communities (ICCoS, ANMMM, MLDM), **IWT**: PhD Grants, GBOU (McKnow), **Belgian Federal Science Policy Office**: IUAP P5/22 ('Dynamical Systems and Control: Computation, Identification and Modelling', 2002-2006), PODO-II (CP/40: TMS and Sustainability), **EU**: FP5-Quprodis, ERNSI, **Contract Research/agreements**: ISMC/IPCOS, Data4s,TML, Elia, LMS, Mastercard.

Appendix A: Evaluation scores

In table A1, we give all obtained scores from the 27 evaluated graduate students (who remain anonymous) in our case study, for each of the twelve subcategories described in section 2.2. Note that, as mentioned earlier, each student received a score between -100 and +100 for each behavioural subcategory.

References

- [1] Sven Maerivoet and Celine Vens. *Academic Oratory Skills – Mastering original and persuasive speech*. Research presented at the Academic English Conference 2003, K.U.Leuven, May 2003.
- [2] Robert Parks. Wordsmyth Online English Dictionary. <http://www.wordsmyth.net>.
- [3] John M. Swales and Christine B. Feak. *Academic Writing for Graduate Students – A Course for Nonnative Speakers of English*. The University of Michigan Press, 1994. ISBN 0-472-08263-9.
- [4] John M. Swales and Christine B. Feak. *Academic Writing for Graduate Students – Commentary*. The University of Michigan Press, 1994. ISBN 0-472-08293-0.
- [5] Martha Davis. *Scientific Papers and Presentations*. Academic Press, December 1996. Selected chapters, ISBN 0122063708.
- [6] Joan Van Emden and Jennifer Easteal. *Technical Writing and Speaking – An Introduction*. The McGraw-Hill Companies, January 1996. Selected chapters, ISBN 0077090276.
- [7] Rui Xu and Donald Wunsch. Survey of clustering algorithms. *IEEE Transactions on Neural Networks*, 16(3):645–678, May 2005.
- [8] Insightful. S-Plus 2000 statistical software. <http://www.insightful.com/products/splus>.
- [9] Leonard Kaufman and Peter J. Rousseeuw. *Finding Groups in Data: An Introduction to Cluster Analysis*. Wiley, 1990. ISBN 0-471-73578-7.
- [10] MathSoft. *S-Plus 2000 User's Guide*, chapter 6 – Statistics – Cluster Analysis – Partitioning Around Medoids, page 359. Data Analysis Products Division, Seattle, Washington, May 1999.
- [11] I. Jolliffe. *Principal Component Analysis*. Springer-Verlag, New-York, 1988.
- [12] Nitsa Movshovitz-Hadar and Orit Hazzan. How to present it ? On the rhetoric of an outstanding lecturer. *International Journal of Mathematical Education in Science and Technology*, 35(6):813–827, 2004.
- [13] Jay H. Lehr. Let there be stoning ! In Martha Davis, editor, *Scientific Papers and Presentations*, chapter 11, pages 263–268. Academic Press, December 1996.

Table A1. All obtained scores from the 27 evaluated graduate students in our case study, showing subcategories (1) and (2) for body language, (3) for answers, (4), (5), (6), and (7) for audience, (8), (9), (10), and (11) for voice, and (12) for timing. Each student received a score between -100 and +100 for each behavioural subcategory.

Nr.	Body language			Answers			Audience					Voice			Timing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
1	-50	-50	100	0	-100	-100	-50	-50	0	0	0	0	0	-100		
2	-100	-50	50	-100	0	0	100	-50	-50	0	-50	0	-50	100		
3	100	50	50	100	0	70	100	100	100	100	100	100	100	-100		
4	-40	-80	100	100	-50	100	100	-50	100	100	0	0	0	0		
5	50	50	100	40	50	100	100	-40	0	-40	80	80	80	100		
6	100	50	100	100	100	100	100	0	50	50	40	40	40	100		
7	100	-50	-50	-50	-50	50	100	-50	-40	-80	80	80	-50	-50		
8	80	-50	100	-50	0	80	100	-50	100	-50	100	100	100	100		
9	100	100	100	100	80	100	100	-60	40	-40	80	80	80	100		
10	-50	-50	100	-50	60	50	100	-80	-100	-100	40	40	-60	-60		
11	50	-50	100	40	60	60	50	-50	-100	-20	60	60	20	20		
12	60	20	60	-40	80	80	80	-50	-50	40	70	40	40	40		
13	100	-60	50	-60	40	40	80	-50	80	80	50	50	-100	-100		
14	80	60	100	100	50	100	100	50	20	40	80	80	100	100		
15	-100	-50	100	50	-50	60	80	-100	-50	20	0	60	60	60		
16	100	-100	100	-100	-50	40	100	-50	40	-50	60	60	100	100		
17	100	100	50	100	-50	50	100	100	100	50	100	100	0	0		
18	100	100	100	100	-50	-50	100	50	-50	50	100	100	0	0		
19	-50	-50	50	0	50	50	100	0	0	0	50	100	100	100		
20	0	0	50	0	-100	-100	50	-50	-50	0	-50	-100	-100	-100		
21	100	50	100	100	-50	50	100	50	50	50	50	50	50	50		
22	100	50	0	100	0	50	50	100	50	100	100	100	100	100		
23	100	50	100	100	0	-50	100	100	100	100	100	100	50	50		
24	-50	-50	50	50	50	0	100	-50	0	-100	50	100	100	100		
25	-50	0	100	50	-50	0	50	-50	-50	-50	0	100	100	100		
26	-100	-100	50	0	50	90	100	80	60	50	90	90	90	100		
27	100	0	50	100	50	100	50	50	60	80	80	80	90	100		

Table captions

Table 1.

A summary of the behavioural characteristics for each of the three groups: -, +, and ++ indicate bad, mediocre, and best performance, respectively.

Table A1.

All obtained scores from the 27 evaluated graduate students in our case study, showing subcategories (1) and (2) for body language, (3) for answers, (4), (5), (6), and (7) for audience, (8), (9), (10), and (11) for voice, and (12) for timing. Each student received a score between -100 and +100 for each behavioural subcategory.

Figure captions

Figure 1.

A graphical depiction of the three groups found by the PAM algorithm. For visual clarity, we reduced the five-dimensional space to two dimensions, resulting in a more intuitive feeling for the groups as they can now be plotted in a two-dimensional graph. The numbers alongside each data point correspond to the anonymous identification numbers of the graduate students in the case study (refer to table A1 in the appendix for a person's individual scores).

Figure 2.

The three resulting groups after running the PAM algorithm. Each quintuple of bars corresponds to one graduate student; the consecutive bars within such a quintuple denote the body language, answers, audience, voice, and timing behavioural categories, respectively. The numbers alongside each data point correspond to the anonymous identification numbers of the graduate students in the case study (refer to table A1 in the appendix for a person's individual scores). As can be seen from the graph, the first group (top line) is characterised by having alternating scores, indicating students with the worst performance. In contrast to this, the majority of the obtained scores in the second and third groups (middle and top lines, respectively) are positive, with a few exceptions. They indicate students with mediocre and best performance, respectively.

Figure 3.

An average graduate student in groups #1 (left), #2 (middle), and #3 (right). Consecutive bars within each quintuple denote the body language, answers, audience, voice, and timing behavioural categories, respectively. Note the especially worse performance with respect to body language (BL) and voice (VO) for students in group #1. In contrast to this, students in groups #2 and #3 have all behavioural categories rather positive. Note that this latter group performs exceptionally well at all behavioural categories (except timing (TI) which only accounts for 5%), as opposed to the more mediocre results of group #2.