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the art of dissemination: what makes an effective scientific presentation?

Morrissey and Sechrest best define the term *presentation* as follows: "A presentation involves the preparation and delivery of critical subject matter in a logical and condensed form, leading to effective communication" [1]. A focused and understandable communication of ideas underlies all forms of academic and scholarly activities, whether in the form of a written article, a presentation at a scientific meeting, or a seminar discussion, and your decisions with respect to choosing the appropriate visual aids and maximizing their visual impact will make a striking difference in the strength and clarity of your presentation.

As biomedical engineers, an essential aspect of our research career is to communicate the findings arising from our studies with the society, in return to their support for our science. The most common means to make our peers aware of our scientific breakthroughs is by publishing the results in a journal article or conference proceedings or by giving a presentation at a regional, national, or international conference. Although most people appear comfortable standing in front of an audience, an exciting and effective presentation entails a thorough organization of thoughts, slides, and visual aids carefully prepared ahead of time.

Many of you browsing through this article have communicated effectively for years, while others may be seeking successful tips here on how to make your next presentation an outstanding performance. Whichever the case, please keep in mind that this article is not intended to teach you how to be a great presenter but to provide helpful tips on presentations, hoping that some of them will trigger old knowledge and others would add to new learning.

Regardless of its technical content or field of expertise, a few steps should be

followed to prepare a successful presentation. These may include, but are not limited to, identifying key objectives, analyzing or anticipating your audience, planning your talk, organizing material effectively to ensure a smooth flow, preparing visual aids, and last but not least, practicing your delivery.

Plan Ahead

Shortly after you receive the invitation to present your work, you should decide on the aspect of your research that you would like to focus on during your presentation and, therefore, tailor your talk to the appropriate situation. Before putting together your presentation, you should consider what main point you would like to convey and what is the objective you wish to achieve. This is also the appropriate time to contact the host and find out details well in advance. Such details relate to the type of presentation you are expected to deliver, the size and composition of your audience, the allotted time for your presentation, as well as general expectations regarding the information content.

As an example, if you are presenting your work at a biomedical imaging symposium, you should be able to anticipate the composition of your audience consisting mostly of physicists and engineers, who will be focusing on the technical aspect of your work, and potentially a few clinicians, who will be interested in the direct applications of your work in the clinic. Therefore, you must ensure that your presentation will provide the necessary background to establish a clinical motivation for your work, contain sufficient technical information to underline the sound science, and address the key advantages of your technique from a clinical perspective. Moreover, you know your talk will be part of a session, and the usual allotted time will range anywhere from 10 to 20 min, with a few minutes dedicated for questions. One of the most common

instincts that you should overcome at this stage is to squeeze all the work that you have done during your degree into that one presentation. Nothing is more frustrating than a speaker switching slides at the speed of light beyond the scheduled talk time, while the session chair suggests to the speaker to wrap up the presentation, and the people in the audience pack up their belongings, trying to make it in time for the coffee break.

Structure Your Presentation

Once you have decided on the message you want to convey, an effective presentation should be organized logically to avoid any confusion. As simple as it may sound, imagine yourself telling a story to a large audience that does not know much about your work but has come to your talk to hear all about it.

Tell Them What You Are Going to Tell Them

The opening should catch the interest and attention of the audience immediately, while avoiding filler phrases and technical jargon. Depending on the type of presentation, an outline slide may be useful. However, if your presentation follows a stereotypical template consisting of an introduction, methodology, results, and conclusion, an outline does not add any value to your talk, and you may, therefore, omit it. On the other hand, if you decide to break down the presentation into different studies or organize it as a multistage approach, a road map would definitely enhance fluency.

To break the monotony, you should always strive to choose slide headings that are more meaningful than the typical generic terms and emphasize specific aspects about your work. Present your material in a novel manner. Use a non-standard ordering of the material to keep the audience interested. Moreover, to help you maintain your own interest in the topic and deliver a fresh and exciting

seminar, reorganize your material as opposed to reworking a previous talk.

Devote the first few minutes to the introduction of the topic. A good approach is to provide several references to previous work in the field performed by other scientists and touch upon basic background information required to set the stage for what you will be discussing in further detail. If you intend to present the prevalence of a disease that your work involves, stay away from statements such as "disease X is the number one killer in country YYZ," as the audience will most likely know it.

Before diving into the core of your research, you may consider wrapping up the introduction by pointing to outstanding issues regarding the topic, and how your approach will address and improve them. This will constitute a great transition to the hypothesis and objectives for your research. However, to not shoot yourself in the foot, make sure you politely state the limitations of the current techniques and propose alternate approaches without putting down the work performed by other researchers who may be sitting in the audience.

Tell It to Them

The main body of your presentation should develop the ideas set out in the introduction in a logical manner and contain information that further supports the key principles. You should avoid including unnecessary text and make use of good visual aids to portray the information and help the audience understand your new findings.

One well-known fact of presenting that has become a rule of thumb is that most people attending a talk will remember not more than five key points, which of course are for you to decide. Ideally, you should strategically choose five key concepts that best describe your work and make sure that you emphasize them accordingly throughout your seminar. Sometimes the use of analogies significantly facilitates understanding of more difficult concepts and helps eliminate confusion.

Often you may find yourself asking a series of rhetoric questions: Is your message getting across? Are they remembering your minor points while completely

missing your key ideas? What if they won't consider the same things as important as you do? How do you get them to remember what you want them to?

Even the most brilliant people in the audience may need your help in deciding what you believe is most important. The best approach is to forget about all the details of your presentation for a minute, forget the organization of the presentation as a whole, and envision your conclusion slide! When compiling the main body of your presentation, always keep in mind your summary slide. It will emphasize the most important points and act as a skeleton onto which you can build the rest of your topic. At the end of the day, you were successful in explaining your work effectively, if the attendees were able to list the five key concepts that you have stressed during your talk.

Tell Them What You Told Them

Signal the beginning of your summary and conclusion ("Now, let us review the main points of today's presentation..."), but don't begin to summarize too soon, otherwise the audience will start to leave the room before you finish, and you definitely do not want them to miss the punch line! Conclude your presentation by summarizing your data, add a comment on the importance of your findings, and explain how your work relates to the issues you raised in the introduction. To help the audience achieve high retention of this final information, stress the main points again in the context of a recommendation for future work. Finally, thank everyone involved; don't forget to thank the audience, and stay tuned for the question period.

Handling the Question Period

Although you may think that your seminar is over once you have finished your presentation, stay tuned for the question period. In fact, this is the time where you will have the opportunity to interact with the audience and show them your knowledge of the topic. After all, anyone can give a good talk with sufficient practice!

Always wait for the questioner to finish asking his question before you begin your answer! Also, it is a good practice to repeat the question so that the entire audience is

aware of what you have been asked. Before providing your answer, take a moment to put your thoughts together and answer the question you were actually asked, as opposed to rambling about something related, yet not relevant.

If a question is asked during your presentation and it is aimed at clearing the ambiguity, answer it immediately. However, feel free to postpone questions aimed at specific problems until the end of your talk, especially if the answer will disrupt the flow of your story.

Try to avoid prolonged discussions with one person, extended answers, and especially arguments, and if it becomes absolutely necessary, feel free to politely break in on a vague, rambling question. Remember, you run the show and you only have a limited time allotted!

It is not uncommon that one of the members in the audience will come up with a question that you cannot answer, and the best advice is to admit that you don't know the answer, as opposed to speculating various responses. Offer to research an answer and to follow up with the questioner later, suggest readings which will help the questioner address the questions themselves, or ask for suggestions from the audience.

Great Visuals Make Great Slides

The slide design and visual aids used in the presentation are of great importance as it enhances the effectiveness of your talk. Considering the technological advancements today, it is tedious but straightforward to put together a nice set of slides with lots of pictures and visual effects.

The best way to get a feel for which colors go well together and how to achieve the best contrast is by experimenting with your favorite graphics software. As a rule of thumb, yellow and white text on a dark blue background always provides a sharp contrast, as it is easy to read and is relatively comfortable for the eyes. Once you have selected a general look, color scheme, and font, make sure that you stick to it!

Always aim for very little text on slides, and overall very few text-only slides in your presentation. Of course, you will have no choice but to include

at least a few lines of text. Nevertheless, try to make text easy to pick up. Use bullet points with no more than two subbullets, list ideas and not full sentences, and limit yourself to three main bullets per slide. Ensure that the font is large enough for it to be legible from the rear of the room (any font size between 24 and 36 points would be appropriate in most cases) and aim at using sans serif fonts (i.e., Arial or Helvetica) as they are easier to read.

Don't forget that the audience is there not to read, rather to listen to what you have to say, and connect it to what they see on the slides. Hence, if you do the talking, then let your slides do the visuals. Use diagrams to explain key concepts! If you use flowcharts to avoid long and overwhelming lists, keep them simple and make sure you dedicate sufficient time to properly explain how everything comes together in the big picture.

Practice Makes Perfect

Don't be fooled by those who claim to have just stepped onto the podium and given a talk that they had put together at a moment's notice. Generally, these presentations fall into two categories: some of them are disjointed and awkward, whereas others have been smoothed and massaged numerous times during previous talks to the point that they lack all excitement.

Practice is the single most important factor contributing to a great presentation. No matter how rushed you are, make time for at least a few practice runs. The effects of practice will be apparent and will reflect upon both your science and your communication skills.

A single practice run is usually not sufficient, especially if the material is relatively new to you. First run through your talk a few times to get an idea of how it flows. Then, seek outside feedback to make sure you are on the right track. Finally, practice all parts equally. Avoid starting from the beginning every time, as that would do nothing but improve the introductory part, while the final parts will be relatively weaker. Therefore, in each of the practice runs, begin either in the middle or at the end of your talk. You

may wonder how many practice runs are sufficient. As a rule of thumb, ten practice runs is about right. Although it may be perceived as a long time commitment, it is really worth it, depending on the impact of your presentation.

Although rehearsing is highly recommended, committing the presentation to memory and performing it by heart is definitely not the best approach. You are there to present not to recite. Make use of notes to briefly organize your thought, but do not read your notes. Too much handling of your notes may raise suspicions among the audience with regard to your preparation.

Rehearse using the same visual tools you would in your actual talk. If you have access to the presentation room prior to your seminar, check it out in advance and familiarize yourself with the system.

On the Day of Your Presentation

Try to take time for a tour of the room where you will give the talk. Check out the venue and make sure that all equipment you need is available and you know how to use it. You'll run the show, so you might as well ask for help with the equipment if you need it. It's better than fumbling around during your presentation. Avoid having equipment delivered 10 min before your talk, as you won't have time to get familiar with it.

Movies are very common these days in presentations, and they also make great visual aids. If you decide to have movies in yours, ensure that you copy them along with your Microsoft PowerPoint slides and link them properly to the right slides. Test them before your talk and make sure they play appropriately on the same system you would be using during your presentation. You've probably seen it happen many times when the presenter starts to talk about an animation that fails to play on the screen, and so try to avoid it.

While some say you can never overdress for a presentation and others disagree, everyone agrees you should never be underdressed. It shows respect toward your audience to dress up for your talk, and furthermore, your attire will often increase your credentials and catch the attention and interest of the audience.

Delivery

One of the most important aspects of your presentation is your actual delivery and how you present yourself in front of the audience. When you're waiting to be introduced by the session chair, take a few deep breaths and visualize your rehearsed opening statement. Don't improvise at the last minute; you've rehearsed for a reason! Approach the podium in an unhurried manner and pause for a moment before starting. This will give the audience a chance to settle down and focus their attention.

During your presentation, relax and be confident. We all respond well to a confident-looking individual. Screen the audience at all times and keep them engaged by maintaining eye contact. In the case of a large audience, try to focus on a few faces spread throughout the room, as this will give the impression of successful eye contact.

Be aware of the body language and avoid distracting gestures and mannerisms. Don't walk all over the place, especially not in front of the screen, as your audience will not appreciate you covering the visuals, and most important, never walk away turning your back to the audience, it is disrespectful!

Be enthusiastic! Absolutely nothing else will help your presentation more than communicating your passion and confidence and you showing enthusiasm and excitement about your work. The audience will recognize your belief and enthusiasm, and it will add credibility to your message.

When it comes to humor, you have to be careful. If used judiciously, it can go a long way in keeping your audience interested and attentive. If you feel comfortable, drop in your humor where it fits, relating to a particular point or during a break between sections. Small amounts of humor and an irreverent comment from time to time can lighten up a presentation and keep your audience awake.

Voice Projection

During your delivery, the audience must be able to hear your voice clearly. Avoid talking too slowly or too quickly, and modulate your voice to highlight certain aspects of your talk. Try to pace yourself



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constantly throughout your talk, but don't forget to vary the pace and tone of your voice to enhance meaning. From time to time, be prepared to pause for a moment to allow the audience to grasp a difficult concept. As a general rule, every slide deserves at least 10 s, while none should run over 100 s. Although useful to establish connectivity between different parts of your work, flow-charts tend to take time to explain thoroughly, and, therefore, you may dedicate slightly longer times to those slides. However, if you find yourself spending several minutes on a slide, maybe you should consider breaking it up.

Once you are done with a slide, remove it! Also, don't start talking about the next slide while your audience is still staring at the previous one. Nevertheless, make sure that you properly transition from one slide to another. A recommended approach is to lead the discussion at the end of one slide on the same page as you start the next. This strategy will enable the audience to stay tuned and not lose focus.

Language Tools

The words you select will dramatically impact the reactions from your audience with regard to both your work and your effectiveness as a presenter. Not only should you use a thesaurus to find better words, with more impact, but also prevent the excessive use of same words. Bring in a breath of fresh air every time you reiterate a similar idea.

Use power and command words to get people's attention and give the impression of confidence and competence. For example, instead of saying, "I think you will probably agree..." you should use, "I am certain you will agree..." or "I recommend you to consider..." versus "I hope you will consider..." Always address your audience in second person, using the powerful word *you*. They will react much better when you address them directly and make them feel engaged in the conversation ("as a participant, you will benefit..." versus "participants will benefit...").

When You're Done ...

Thank your audience, hosts, and collaborators. Make materials available, as some of the people in the audience will go back to their office and tell their friends and colleagues what a great talk they missed! Most important, make yourself available, both after the presentation, as well as for future references. Provide them with a method of reaching you, e-mail being the most common these days! Last but not least, get feedback! Try to find out what they thought of you and your presentation, what they learned, what they were hoping to learn but didn't, what you should do to improve the presentation and your communication skills! Every presentation you give will be a lesson, and you should be able to learn something new in every presentation you give. However, don't forget, there is no such thing as the perfect, ideal presentation!

Best of luck with the preparation and delivery of your next presentation! If you have any further questions, or if you require additional information on this topic, feel free to contact me anytime at clinte@imaging.robarts.ca.

Finally, I would like to thank Grace E. Parraga (Imaging Research Laboratories, Robarts Research Institute, London, Canada) for her excellent course notes on "Principles of Communication for Engineers and Scientists," offered within the Biomedical

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President's Message (continued from page 4)

countries: Turkey, United States, Mexico, China, and Canada, and will be held in Buenos Aires in 2010. As an international society, this was a strategic plan to serve our broad-based membership. To maintain consistency and help volunteer organizers, this year, a conference editorial board has been introduced to assist with the review process. EMBS should keep an open mind in the development of new special topics conferences that address the emerging technologies. Thanks to Vice President Zhi-Pei Liang for implementing these new procedures.

Publications

The first publication of EMBS was *IEEE Engineering in Medicine and Biology Magazine*, followed by *IEEE Transactions on Biomedical Engineering*, which remains our flagship journal. EMBS has met the challenge of emerging technologies by the strategic introduction of new journals: *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *IEEE Transactions on Information Technology in Biomedicine*, and *IEEE Transactions on Nanobioscience*. All are doing well financially and have been improving their impact factors. Last year, the IEEE approved a new EMBS publication, *Reviews in Biomedical Engineering*, which will be published for the first time in 2008. In addition, EMBS is a cosponsor of several other transactions with other IEEE Societies: *IEEE Transactions on Medical Imaging*, *IEEE Transactions on NanoBioscience*, *IEEE*

Transactions on Computational Biology and Bioinformatics, and *IEEE Transactions on Biomedical Circuits and Systems*. To address the broad range of topics relevant to biomedical engineering, EMBS needs to continue to be open to participation in new cosponsored publications. Thanks to Vice President Andrew Laine and production editor Bin He for expert management of these publications.

Member and Student Activities

EMBS also has good news in terms of membership. Thanks to dedicated efforts of Vice President Jorge Monzon, our membership has increased while the IEEE as a whole has been losing members. The number of local EMBS chapters has more than doubled, thanks to the hard work of Nathalie Gosset. During the last year, I have met some of our local chapters and found that they have impressive activities but feel disconnected from EMBS. Because of geographical dispersion, it is very hard to change this perception. Thanks to Lisa Lazareck for her work with Graduates of the Last Decade (GOLD) activities, which are an important pipeline for retaining EMBS members.

Finances

As mentioned earlier, EMBS is in a strong financial position. Although we need to continue to be vigilant in avoiding unnecessary expenses, we are now in the enviable position of considering how we can best invest some of our resources to meet the goals of EMBS,

thanks to the financial management of Vice President Craig Hartley.

Executive Office

Although all of these activities are linked to volunteers, we should not forget that the ongoing activities and daily operations take place in the EMBS Executive Office. We are fortunate to have a knowledgeable executive director, Laura Wolf, who not only handles daily challenges but more importantly proposes and implements important innovations for EMBS. On the conference front, she is ably assisted by Jodi Janiszewski, who tirelessly and cheerfully resolves conference-related problems. We are also pleased to welcome a new member to the Executive Office staff this year, Lynn Bowlby.

Strategic Goals

It is important for EMBS to establish strategic goals, both short term and long term. The following is a partial list to begin discussion.

- ▶ Support our traditional areas but be proactive in going into emerging areas.
 - ▶ Increase cooperative activities both within and outside the IEEE.
 - ▶ Raise the visibility of biomedical engineering.
 - ▶ Address the needs of industrial members.
 - ▶ Communicate with local chapters.
 - ▶ Invest wisely to achieve our goals.
- Send me your thoughts for strategic goals at d.hudson@ieee.org.