Statistical Consulting (2002)
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Communication

The ability of a consulting statistician to communicate effectively is very important. No surprise there, of course. Effective communication is certainly a desirable skill worth developing wherever there exists the need for interaction between two parties. During a statistician's training, however, considerable emphasis is often placed on developing the necessary technical skills, leaving communication as something that can be "picked up later." For the consulting statistician, "later" is no longer an option; good communication skills are required to be an effective consultant.

In this chapter, we specifically focus on the role of communication and explore some of the common elements and skills that are involved in effective communication. These are discussed in detail with a complete description of our approach and "how-to" guidelines are provided. Of course, developing good communication skills requires time and effort and our guidelines are not intended to be a substitute for this.

We begin by considering the following situation. When a statistician is involved in a project, a process takes place involving the transfer of information. Whether this is done with a group of collaborators or an individual client, there are certain common elements involved in the communication process:

1. Verbal interaction with the client(s) which continues until substantial progress has been made on a project.

2. Preparation of technical summaries, report writing, and presentation of results.

Certain skills will be required to perform these tasks effectively and in the next two sections we consider what is involved in interacting verbally with the client. Since the focus in this chapter is on communication, we proceed directly to the report writing stage of the project. While this presumes the analysis was able to be performed using the appropriate statistical methods, details concerning specific statistical techniques are covered in the next chapter and are not needed for our discussion on report writing.

We also discuss the role of oral presentations and provide details on how to make these presentations effective. The importance of quality graphics for presentation purposes is addressed in Section 2.6. A short introduction on the use of the PowerPoint software for enhancing presentations is given at the end of this section.

Before continuing, we must emphasize that any guidelines we provide for effective communication will not fit every consulting situation. However, it is hoped that the reader will benefit by having the opportunity to follow our approach in detail, and adapt it to specific situations as needed.

2.1 Verbal Interaction

There is a variety of situations where the statistician must interact directly with a client or group of collaborators. The main purpose of this interaction is to exchange information concerning a project of interest and to do this effectively the statistician needs to develop communication skills in the following areas.

1. Initiating the interaction process.
2. Understanding and defining the problem.
3. Evaluating the technical knowledge of the client/collaborator.
4. Assessing the overall issues and objectives of the project.
5. Identifying the statistician's specific contributions to the project.

For the purposes of this discussion we refer to the client(s) or collaborators as simply, the "client." While this word has certain overtones associated with it, the communication skills we need to develop are the same whether we are dealing with an individual client, or a group of collaborators. That is, these skills are not tied to a specific type of consulting environment where a certain nomenclature may be preferred.

Initiating the Interaction

So where do we start? How do we initiate the interaction? Deer (2000) and Bohn and Zahn (1968) both deal with this particular issue in detail and place considerable emphasis on the importance of creating positive first impressions. The physical setting of the meeting room and our initial nonverbal behavior towards the client will create their first impression of us — and we haven't even said "Hello" yet. We consider some of these nonverbal cues in the example presented in Chapter 4. Common courtesy and respect obviously go a long way towards creating a positive environment for our consultation meetings. Some simple things we can do to help make clients feel comfortable when we greet them are:

1. Stop what we are doing *immediately* and get up to greet the client. We may need to take the client's coat or indicate where they can put their briefcase.
2. Make eye contact and smile. This conveys the message that we are pleased to see the client and gives us an opportunity to assess the general demeanor of the client. If they appear rushed, give the client a little time to relax. Talk about the weather or other peripheral matters before asking about their project.

Once we are over the preliminary introductions, the client may want to show us some data, or mention a statistical procedure they want to use. However, it is necessary to start from the beginning. That is, we need to start with the context of the problem because without context, data have little meaning.

- How much do we need to know?
- Ask lots of questions.
- Always be prepared to take notes.

How much do we need to know? What we are really asking is how much information we need from the client in order to resolve the statistical aspects of the problem. Of course, the problem has yet to be well defined so some strategies are needed to elicit the appropriate information. The obvious approach is:

Ask lots of questions: At this early stage of the consultation it is often useful to have the client begin the session by describing the project in their own words. This gives us the opportunity to learn about the client's field and make appropriate interruptions whenever unfamiliar

or specialist terminology is introduced. Never heard of the "EQRT" scale? Then ask! We are not expected to be an expert in every field of scientific inquiry. Now read the last sentence again. Why? Because neither do we need to become an expert in the client's field.

When we do ask a question, we must also *listen* (carefully) to what the client says. Remember that clients come to us for statistical advice. They cannot be expected to know that certain terminology has quite specific meanings in statistics. Saying a factor was "significant" implies something quite different to us than if they had said it was important. The reverse could apply just as easily, of course. The client could have said "important" when, in fact, they meant significant (based on a previous study, for example). In our experience, clients often tend to do two things:

1. Use statistical terminology inappropriately. We should always double check what the client means.

2. Fail to mention important variables such as design factors that were employed in the experiment. That is, we also need to listen for what is *not* said.

Always be prepared to take notes: Naturally, we were ready to take notes during this question-and-answer session. ... Do **not** assume we will be able to remember all the details about the client's project later. Taking notes *during* the consultation session is an essential part of the documentation process (Section 2.3) and we emphasize the importance of adopting this practice.

Defining the Problem

Our initial task is to try to understand the context of a project from the client's perspective. This means we need to learn something about the client's field and its associated terminology before trying to define the problem. As we become more familiar with the "context" of the problem and begin to communicate with the client using a common basic terminology, the purpose of our questions can then be directed towards the following aspects of the project. This information will be helpful in defining the problem and identifying the statistical issues involved.

- Background of the project
- Status of the project
- Aims of the project
- What the client expects

Background Projects are often based on previous studies in which case there may be an established or accepted method of analysis. If so, obtaining a relevant reference from the client can help us ascertain whether the established method of analysis is reasonable and applicable to the client's problem.

Status What is the status of the project? If the study is in the pre-experiment or planning stage, our contribution can be important in ensuring the planned experiment will produce reliable data for the subsequent analysis. If the data have already been collected, we will need to direct our questions towards the collection process. How reliable are the data? Is the client aware of any outliers in the data? Was the experiment performed in accordance with the usual principles of statistical experimentation: control, randomization, and replication? Is there enough evidence (sample size and structure in the data[1]) to support the objectives of the project?

Aims What are the aims and hypotheses associated with the study? Are the client's objectives commensurate with the results that can be obtained from a statistical analysis? In some cases, certain hypotheses may need to be reformulated in order for the statistical analysis to provide valid conclusions. We should also make sure the client understands the distinction between causality and conclusions based on a statistical analysis.

Expectations What does the client expect from us? We are not magicians, nor are we directing the project. Our responsibility should always be to the statistical aspects of the problem; it is the client's responsibility to articulate the importance and motivation for the project.

[1] In one project, we were ready to start the analysis of a rather large dataset (100 MB) only to find out that a key variable had not been recorded in the original study. Hence the objectives of our project could not be met.

Technical Knowledge of the Client

Defining the statistical aspects of a client's problem for ourselves is the easy part. Now we need to explain them to the client. At the same time as we are defining the problem, it is useful (and sometimes revealing) to ascertain the client's knowledge and understanding of the statistical aspects of the project. For example, a client may ask, "How large a sample do I need?" How should we respond? In terms of the power or accuracy[2] of statistical tests, or with a more familiar notion like margin of error? This clearly depends on the client's technical knowledge. In our experience, margin of error often provides a useful starting point and avoids possible misinterpretation of terms such as accuracy or precision.

- How well does the client understand the project?
- How much statistical knowledge does the client possess?

As we indicated above, there may be a basic or established statistical methodology that is well accepted in the client's field. However, knowledge of a statistical procedure does not necessarily mean the client fully understands the concepts underlying the statistical procedure. Thus, part of our role can be an educational one. We consider some issues that may need to be addressed in this respect.

Educating the Client The client did not come to us for a statistics lecture! Our explanations should be given in the context of the client's project; provide the client with an interpretation of the outcome and purpose of a statistical procedure, not the mathematical details. For example, a P-value can be explained in terms of "risk" rather than a probability based on some type of distribution. Be patient, but avoid getting stuck on details that are not essential — *How much do we need to know?* also applies to the client.

Level of Sophistication The statistical methods employed for analysis need to be appropriate for the problem and this may require introducing the client to more sophisticated approaches. However, we should not try to make the statistical analysis more complicated than is really necessary. The client needs to be able to interpret the results of the analysis irrespective of the level of statistical sophistication.

[2]When asked, "How accurate do you want your test results to be?" a client promptly informed one of the authors they wanted the results to be 100% accurate. We quickly returned to the matter of determining an appropriate sample size.

Formalizing the Problem A more complicated issue is the potential need to formalize the ideas of the client. They may think about their work in a more intuitive way which needs to be carefully formalized before the statistical analysis of the problem can be performed. The time spent in formalizing the problem is well spent because it will help the client understand the research from a statistical perspective. In some cases, this may even lead to a better formulation of the research objectives.

Example 2.1 *There will be an interaction between* PST *and* PREF *by* GROUP.

In Section 9.1 (*Improving Teaching*), the hypothesis stated above was the client's best approximation to the "formal" hypothesis statement of the problem. What the client really wanted to know was whether the factors PREF and GROUP had an effect on the response PST. That is, was there was an interaction *effect* due to these factors.

Overall Issues and Objectives

At this stage we should have established a sufficiently good communication channel with the client and can now go into details concerning the overall statistical issues involved in the project. The following items should be able to be discussed in a language that we both understand.

- Aims and hypotheses of the project.
- Current or prior methodology, if any.
- Intended use of postexperiment results.

Objectives In some studies, the objectives may only be exploratory in nature and the appropriate hypotheses have yet to be formulated. On the other hand, if there are specific objectives of interest, we need to ensure that the experimental design will provide statistically valid results. If the experiment has not yet been conducted then we need to address issues related to the design such as sample size, randomization, and control, as well as implementation issues. If the data have already been collected, we need to consider whether the objectives of the study will be met by the current data. Additional data may be required.

Methodology To ensure that the statistical procedure is applied appropriately, specific issues will need to be addressed such as:

- What is the data type of each variable?
- Are there outliers or missing values present?
- Do certain constraints exist in the process?

This requires interacting closely with our client during a consultation session. (Avoid confusing the client: missing values generally tend to be, well . . . missing!) We present an example of this type of interaction in Section 3.5, where some regression-specific questions are posed. We should also compare the current or prior methodology that is being used in the project with established statistical procedures that may be more modern or more appropriate.

Postexperiment It can be worthwhile to consider the intended use of the postexperiment results. For example, does the outcome of the study depend critically on obtaining significance for a particular hypothesis. What are the consequences of getting a nonsignificant result? Make sure the client understands that we cannot simply change the result of an analysis because it doesn't support the client's initial objective.

Specific Contributions

The final stage of our verbal interaction with the client involves identifying our specific contributions. This is important to ensure that both we and the client understand clearly our respective roles in the project. The following items should be addressed as necessary.

Data management If we are responsible for performing the actual computations the client needs to provide us with the data in suitable format.

Data Analysis Error checking: The client needs to be aware that the initial stage of our analysis will involve checking the data. The client will need to provide us with any corrections.

Statistical Analysis Both we and the client have agreed on the method that will be used to analyze the data and the details of performing the computations.

Report writing Whether there is an expectation of presentation quality graphics and tables or any special requirements in the report that will be written.

Time frame There needs to be a realistic time frame to allow us to perform the analysis and complete the written report for the project.

2.2 Other Aspects of Verbal Interaction

Persuasive Communication

In practice, the different components of verbal interaction that we have just discussed may be performed simultaneously. The art of persuasive communication requires the creative combination of these components to make the interaction with our client more efficient. Handling a consultation session well relies on good organizational skills. We should be prepared to interrupt (politely) and redirect the client towards relevant issues as necessary. This will make our consultations sessions more productive and enable the analysis phase of the project to commence.

Initial Contact

Prior to our initial appointment with the client, we may have already established indirect communication and gained some information about the project. In this case, the focus and direction of the discussion during this initial meeting may be predetermined to some extent. However, it is important that all prior information be reiterated at the beginning of the consultation to ensure there is mutual agreement on the content of previous communications. Doing this also helps to develop the nature of the working relationship between ourselves and the client.

Decision Time

In certain cases we may need to refuse participation in the project due to various reasons. For example, we may have constraints which would prevent us from completing the project in the time frame required by the client. In legal cases, there may simply be a conflict of interest because of our work with a previous client. In these situations, the decision not to participate in the project would usually be able to be determined prior to the initial consultation session.

What if the need to make this decision arises during the consultation session? Informing a client of our decision not to participate in a project can be difficult, but needs to be done during the initial stages of the consultation process whenever possible.[3] It is crucial that the client is not led to false expectations of our intent to participate in the project. More important, the client has invested their time in discussing the project with us and now needs to look elsewhere. The key issue is:

Knowing when to walk away.

[3] Our decision to decline a consulting project certainly needs to be made before performing any actual analysis; we may be legally or contractually bound to complete the project analysis if it is started.

Of course, knowing when to walk away does **not** mean we just simply up-and-leave! Indeed, an important part of our decision will be informing the client about the problems in their project and providing advice or recommendations that are appropriate to overcoming the limitations of the study. We may even generate a "new" project; this time with the added bonus that we can participate in the design phase of the study. Some reasons why the best option may be to decline a consulting project are:

- The sample size is too small for any meaningful analysis or is simply too large for our current computing resources.
- The data is biased or poorly gathered and there is no opportunity for further planned data collection.
- The client may not really understand their project or their expectations of the analysis results are unrealistic.
- We may not understand the client's project or have limited expertise in the type of statistical analysis required for the project.
- We have moral or ethical objections to the project. This includes statistical ethics such as a client who "requests" a particular method of analysis which is clearly inappropriate.

Negative Outcomes

"Oh, I'm sorry. Here. You can put your gum in this (the waste basket)."

Since the context of the statement is missing, two possible scenarios in which this statement could have arisen are: we were a bit slow in picking up the client's nonverbal cues; after starting the consultation meeting, we noticed the client was chewing gum. In the first scenario, our statement was simply a response to a nonverbal request initiated by the client, prefaced by a genuine apology as a friendly gesture. In the second scenario, our statement clearly served a different purpose: we were attempting to address a "negative" situation that occured during a consultation session.

The above scenario is somewhat trivial, of course, but it does provide a useful example for illustrating some of the issues that the statistical consultant may need to consider when attempting to deal with negative situations. These are summarized below.

Perception What is the problem? Every client has mannerisms and idiosyncrasies that we may find "annoying," but this hardly counts as a negative "situation." Addressing unimportant problems will only make the situation worse. If a client chewing gum is not a big problem for you, let it slide.

Consequences What are the consequences of addressing a problem?

- By exposing the situation, we may convey a very negative impression to the client. (The client may be offended by the way we made the request: "What's with the insincere apology: 'Oh, I'm *sooo* sorry.' ")
- We may end up spending valuable time on issues unrelated to the client's project. (The client berates us for using the indirect approach. "You could've just asked me straightout." The situation is now worse and we need to spend more time trying to make the client feel less slighted.)
- It could backfire on us. (The gum is something the client needs for medical reasons. We assumed it ordinary gum and now face the two problems above.)

Timing When should we address the problem? It is usually better to address simple problems immediately, but in some cases it may be better to "sleep on it." That is, defer addressing the issue until the end of the consultation session. Perhaps even try to think of a creative solution to employ at the beginning of the next session which might circumvent the problem.

Win-Win What is the purpose of addressing a negative situation? The aim, of course, is to achieve a positive outcome. The consultant and client both benefit from understanding what the problem was and are able to move on to more important matters. Deer (2000) refers to this as a "Win-win outcome" and provides numerous examples of positive and negative situations that a statistical consultant may encounter.

Continuation ...

Developing good communication skills is an evolving process and while experience will certainly help, it is important for a statistical consultant to continuely reassess their performance. How might that difficult situation we got into last week, have been better resolved? Why did it take *two* meetings to clarify the objectives and work assignments for this project? Cultural differences may also have an impact on our interaction with a is client. Clearly, we have not addressed every aspect of verbal interaction in our presentation above, nor have we considered all the different types of consulting situations that a consultant can expect to encounter.

Fortunately, there are many other sources available that can help us improve our communication skills! The text by Deer (2000) and accompanying video are certainly worth looking at. Some articles relevant to this section are: Tweedie (1998), Finney (1982), and Lurie (1958). Finally, business orientated publications often provide useful advice that can be incorporated into the statistical consulting environment. See, for example, Hamilton and Parker (1993), and Yeatts and Hyten (1998).