Asking Good Questions

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Introduction

We've been talking about communication again and again.

Today, we discuss some of the specific kinds of information that must be exchanged.

We cannot read clients' minds, but we must know their needs and preferences.

This is often in the form of questions, so we need to know what questions to ask.

This lecture follows Chapter 5 of Derr (2000) and section 2.1 of Cabrera and McDougall.

Process

Statistical consulting usually looks like:

1. Client's problem
2. Statistical framework
3. Statistical solution
4. Client's solution

This is usually an interative process, so we may go back to 1 and repeat a few times.

Oops

> *Better a poor answer to the right question than a good answer to the wrong question.*
>
> *John Tukey*

> *Type III error: Providing the right answer to the wrong question.*
>
> *A. W. Kimball*

Type III errors are a constant risk — we must know the right question!

Oximeter

An **oximeter** is a noninvasive device that measures pulse rate and oxygen saturation in blood. With humans, measurement is done using a finger clamp.

Source: http://en.wikipedia.org/wiki/Pulse_oximeter

Oximeter usage with dogs

- Veterinarian wishes to know if the oximeter reading depends on the position of measurement on a dog.
- Uses 40 dogs, each measured in 4 fixed locations nearly simultaneously.
- Analysis is like a randomized complete block design
- Statistician suggests RCB Anova, with multiple comparisons, which the client can do on her own.
- Everyone is "happy."
- But nothing seems to work right.

What are the units of the oximeter?

But ... oximeter returns percent saturation, which is typically in the range of 70% to nearly 100%.

Need to account for using percentages: probit, logistic, or at least $\sin^{-1}(\sqrt{\text{fraction}})$.

It is very easy to answer the wrong question.
We need to work hard with clients to avoid it.

Solution?

- **Slow down!**
- **Ask questions!**
- **Listen carefully!**
- **Clarify all terms!**
- Take notes, if needed.
- Keep records of what you do.

So whadda ya know?

Not much, you?

What questions should we ask?
What do we need to know?

I like to go from general to specific:
Start with big picture,
Learn background,
Learn objectives,
Get to specifics,
Determine my role.

Background

- What field?
- New situation or old?
- Relevant methods and/or literature?
- Background reading?

Area of application

Background helps avoid type III error.

Learn about your client's field.

Learn about statistical methods standard in the field.

Learn the common problems in the field.

Ask if you don't understand.

Client Background

How well does the client understand the project?

How much statistical knowledge does the client have?

Will we need to educate the client?

What level of statistical sophistication is appropriate for this client?

Do we need to help the client formalize the problem?

Our Contribution

What can we bring to the table?

- Experimental/survey design and planning
- Data management and quality control
- General data analysis
- Statistical inference
- Statistical graphics
- Report writing

Learn about the project

Project status, from Chatfield (1995)

1. Project formulation.
2. Data collection.
3. Data coding, entry, quality control.
4. Data exploration.
5. Model building and inference.
6. Comparison with prior work.
7. Reporting results.

More generally, planning stage or analysis stage.

Planning stage

Wow, you're lucky!

- Goals and objectives
- Resource constraints
- Best way to collect data
- Sample size
- Plan for analysis

What kind of project?

Designed experiment — help with

- Units
- Treatments
- Responses
- Randomization
- Design
- Power

What kind of project?

Sample survey — help with

- Target populations
- Variables
- Sampling design
- Sample size
- Sources of bias
- Sampling instrument
- Training
- Coding

What kind of project?

Observational study — help with

- Data sources
- Linkages
- Data quality
- Sources of bias

Analysis stage

More common. You'll need to determine

- Goals and objectives
- How data were collected
- Limitations of data
- Was design followed
- Can goals be addressed
- Plan for analysis
- Triage/damage control
- Postmortem

Ask ...

... the statistician, if [s]he is really to assist the scientist, must perform a necessary, but irritatingly annoying task: he must ask the scientist impertinent questions. Indeed, the questions, if bluntly asked, may appear to be not only impertinent but almost indecently prying — because they deal with the foundations of the scientist's thinking. By these questions, unsuspected weaknesses in the foundations may be brought to light, and the exposure of weaknesses in one's thinking is a rather unpleasant occurance.

W. Lurie (1958)

... politely

> *The statistician will, then if [s]he is wise in the ways of human beings as well as learned in statistics, ask these questions diplomatically, or even not ask them as questions at all. He may well guide the discussion with the scientist in such a way that the answers to the questions will be forthcoming without the questions having been even explicitly asked.*
>
> *W. Lurie (1958)*

It is a consultation, not an interrogation.

Leading Questions

The "desired" answer is implied in the question.

I assume that you got informed consent?

Were you able to get a random sample from this population?

You often get the desired answer, regardless of the correct answer, so these should be avoided.

Closed Probe Questions

Closed probe questions ask for specific information, usually with a Yes or No answer.

Often begin with 'Can,' 'Did,' 'Will,' 'Are,' 'Do,' etc.

- Did you interview every person on the list?
- Did you randomize treatments to units?
- Are there any missing data?

Closed Probe Questions

Use them for obtaining very specific information, but

- They must be clearly worded.
- They must be free from jargon.
- They can seem very intimidating.
- Their answers have a narrow scope.

Forced Choice Questions

This is a multiple choice question.

- Are you able to change the order in which different animals receive the treatments, or must the order be the same for each animal?
- Is this going to be a mail-in survey or a telephone survey?

Use them for obtaining very specific information, but

- They must be clearly worded.
- They must be free from jargon.
- They must include all possible responses.

Leaving out options may seem to imply that only those included are acceptable.

Open Probes

Open probes solicit general information.

Can be

- Focused: "I'd like to hear more about the responses you plan to measure."
- Broad: "What factors are likely to affect the response?"
- Transitional: "Is there anything more that we should cover concerning the layout of the soil samples before we go on to discuss the variables you plan to measure?"

Open probes get long responses, closed probes get short responses.

Concrete Paraphrase

Make sure you understand the technical details. Restate factual information and get an OK.

Often contain "Let me make sure that I understand" or "Do I have this correctly?"

- So you will be targeting all students on this campus, and mailing out this survey to a random sample of them?
- So the masers could get their energy either from radiation or from shockwaves, is that correct?

All together now

You need all types of questions (except perhaps leading questions) to get the job done.

I like to go from general to specific when consulting, so ...

I use open probes to introduce a topic, closed probes to get specifics, and paraphrasing to summarize.

Start with open and move to specific, but give client the chance to give more information.

However, there is no one true way to have a consulting meeting.

Summary

- We want to answer the client's questions.
- To do this, we must ask the right questions.
- We need to get sufficient information without intimidating or insulting the client.
- Questions needed will depend on stage of the project, technical skill of the client, needs of the client, and other factors.