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Creating Models in Psychological Research

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ISSN 2192-8363
SpringerBriefs in Psychology
ISBN 978-3-319-15752-8 ISBN 978-3-319-15753-5 (eBook)
DOI 10.1007/978-3-319-15753-5

Library of Congress Control Number: 2015934454

Springer Cham Heidelberg New York Dordrecht London
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To Catherine

Preface

Each research project is unique and must retain its uniqueness in order to be of scientific value. As such, researchers (including students at the master's and PhD levels) are entitled to express their interpretation of the world they are investigating. This book stresses a multimethod approach that is described in detail throughout each chapter. The researcher is encouraged to abandon the security that a favored approach may provide and accept a wider, multileveled view.

In the USA alone, psychological disorders of all sorts affect the lives of people in astonishing numbers: generalized anxiety disorder (GAD)—6.8 million adults; panic disorder—6 million; social anxiety disorder—15 million; specific phobias—19 million; obsessive–compulsive disorder (OCD)—2.2 million; post-traumatic stress disorder (PTSD)—7.7 million; major depressive disorder—14 million[1]. Greenberg et al. (1999) calculated that in the 1990s, anxiety disorders amounted to over US $ 42 billion/year in economic losses. As of 2014, The US National Institute of Mental Health (NIMH) estimates the total cost associated with serious mental illness to hover over US $ 300 billion/year[2]. As pointed out by McLaughlin et al. (2013, p. 823) after examining data gathered from a survey of 6483 adolescents aged 13 through 17 years, "Nearly two-thirds of U.S. adolescents report experiencing 1 or more PTEs[3] by age 17 years, indicating substantial exposure to PTEs during childhood and adolescence, and 4.7% of U.S. adolescents meet lifetime criteria for PTSD."

This outlines the importance of properly modeling psychological phenomena and constructs, because better assessments and potentially better treatments can then take place, making people's lives better in the process and the economy less affected by this heavy burden.

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[1] Source: Anxiety and Depression Association of America. http://www.adaa.org/about-adaa/press-room/facts-statistics. Accessed Nov 18, 2014.

[2] Source: National Institute of Mental Health (USA)
http://www.nimh.nih.gov/health/statistics/cost/index.shtml. Accessed Nov 13, 2014.

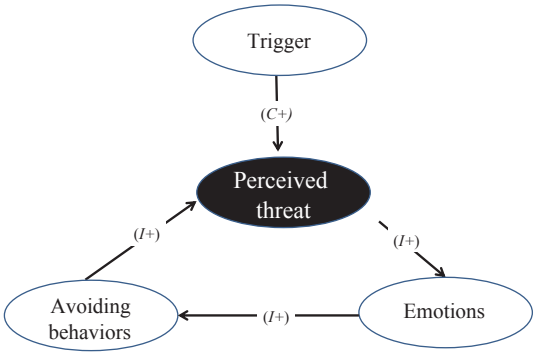
[3] Potentially traumatic events such as rape, domestic violence, witnessing aggression, etc.

This simple guide is designed most particularly for master's and doctoral students in psychology as well as new researchers (all referred to as "researcher" in the body of the book).

It will assist the researcher in: (1) developing flawless psychological models that will support his thinking and research endeavors; (2) identifying shortfalls and errors commonly found in research (e.g., erroneous scales, use of additive questions to boost Cronbach's alpha, etc.); (3) giving him[4] effective techniques to perform qualitative and quantitative research that are rarely discussed in other research books; (4) proposing a solid approach for creating questionnaires; (5) initiating him to the power of data percolation[5], and; (6) providing guidance for writing his thesis or paper with a step by step methodology.

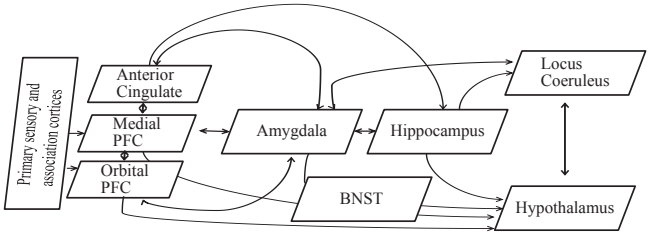
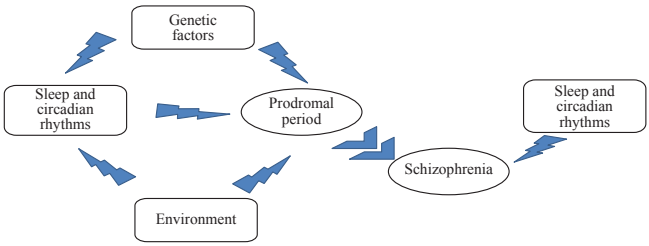
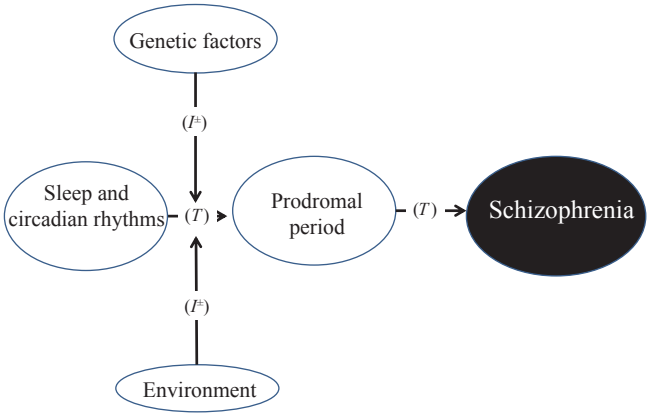
This book does not replace traditional books on methodology in psychology; rather, it complements them.

A Few Questions

A few questions	
The project	What is the main research theme of the researcher? (one sentence consisting of a subject, a verb, and a complement)
	What anxieties are experienced when thinking about the research project?
	What is planned to alleviate whatever concerns that may be?
Attitude	Define attitude towards research
A standard psychological construct model (bubbles and arrows)	 A trigger causes the individual to perceive a threat, which generates emotions, which then influences the individual in her/his attempt to avoid the source of said perceived threat, which then leads to increased perceived threat when escape is not possible. An anxious person would be more likely to perceive a threat than a non anxious person (see Ein-Dor et al. 2011)

[4] The masculine form is considered a neutral form in the present book.

[5] See Mesly 2012; Mesly 2012a.

A few questions	
A process model instead of a construct model (parallelograms and arrows)	 (Inspired from Hostinar et al. 2014, p. 260). When processes are discussed, parallelograms and arrows are used, not bubbles and arrows
A model that is not using the method taught in this book	 (Zanini et al. 2013, p. 2635)
The same model using the method used in this book	 The model was drawn based on information provided in the article of Zanini et al., 2013. With time, disruptions in sleep patterns lead to prodromal periods, which with time may lead to schizophrenia. Genetic and environmental factors may have a reinforcing effect of this particular dynamic

Acknowledgement

I wish to thank all the people who helped me over the years to put this book together, including Sharon Panulla and Sylvana Ruggirello (Springer Psychology), as well as Stéphane Bouchard (Cyberpsychology-UQO), Jean Cadieux (University of Sherbrooke), Francisco Grapain Núñez, and Claire Poulin, who generously provided some short clinical cases to complement the theory.

Contents

Special Codes

CMP	Consolidated model of predation
CMSP	Consolidated model of sexual predation
CMFP	Consolidated model of financial predation

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Chapter 1
General Principles

1.1 Introduction

This chapter offers a few general rules for conducting research, starting with a proper attitude and a quest for multidisciplinarity.

1.2 Where to Start

The researcher will spend countless hours, months, and years on one particular topic related to psychology. It is thus most advisable that this topic be an important part of him. But nothing guarantees that he knows exactly what he wants or that what he thinks is not biased from the start. There is a basic illogical rule in research that professes that researchers should remain neutral and that by doing so they show high levels of objectivity and rigor. This is an erroneous assumption.

First and foremost, before commencing research with other participants (which is why in Fig. 1.1 below the first participant is "me"), the researcher should know who he is[1]. There are two reasons for this: first, he needs to discover what his deepest motivations are, so that he does not get discouraged, bored, or distracted by new opportunities midway through his research project; second, he must identify what biases he has prior to doing research. He has to find ways to get away from his conceptual schemas. As Parkhe (1993, p. 229) put it: "[…] any significant research requires that one tries out new paths and faces ambiguity so as to define new variables […]".

How to go about this? It is actually very simple.

[1] See Ellis 2004; Bochner and Ellis 2006; Ellingson and Ellis 2008.

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SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5_1

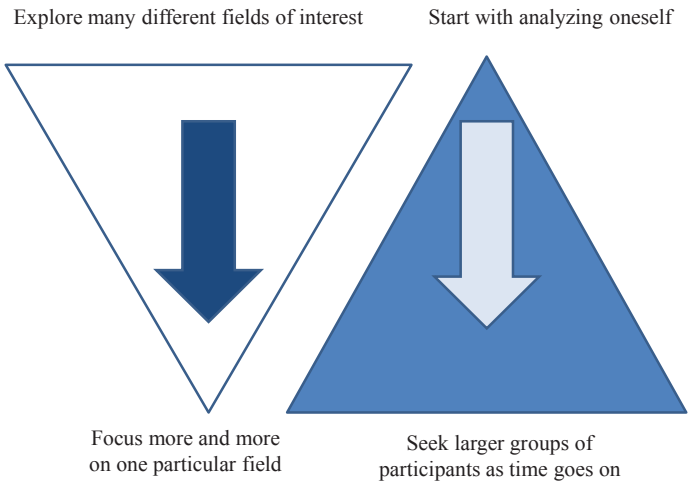

Fig. 1.1 A research method

Here is what to do: the researcher submits himself to a form of autoethnography. He has someone question him as if he or she were a journalist or even a police officer. This technique is not only an eye opener, but also a mandatory step.

Suppose the researcher's main topic of interest is sexual predation. In the first interview, the "someone" (e.g., a journalist, a fellow student, a coresearcher) would ask general questions such as: "Why do you have an interest in sexual predation? Have you personally known victims of sexual predation? How would you regard a friend if you discovered she/he is a sexual predator? What do you think of the current laws with respect to sexual predators? Do you feel the problem of sexual predation is exclusive to certain societies? etc." In a second interview, the interviewer would dig further into the researcher's motivation and mindset: "Have you personally been a victim of sexual predation? Putting yourself in the mind of a sexual predator, what would you do? Putting yourself in the mind of a 12-year-old female victim of sexual predation, what would you feel? etc."

A close examination of the answers would certainly disclose some biases, views, and/or emotions that the researcher has and that, if he was not aware of them, would taint his quest for the truth about sexual predation[2].

Also, the researcher's topic must have something at stake (rule number 2). It should have two opposing sides to it. The researcher must choose a topic that stretches the imagination and that forces people to pick a side. If he chooses a topic where the stakes are low, he will raise little interest, have difficulty finding participants, have difficulty funding his research, get bored or be outdone by someone else doing the same research as him, but faster.

[2] See Hirschman 1986; Holman-Jones 2005; Lapadat 2009; Maréchal 2010.

Rule number 3 is the following: the topic the researcher is investigating must generate action and this action must be anchored in a particular context. This being said, well it may be that after his research is finished, he comes to the justifiable conclusion that no action is needed and the *status quo* should remain. This is acceptable because he has taken the steps to prove this very point.

Suppose the researcher's topic is about legal procedures currently in place with respect to sexual predators. The researcher may find that he ought to propose new, tougher measures to the government. He may also come to the conclusion that the current judicial system works perfectly well and does not need to be improved. Both sets of conclusions are acceptable if they are supported by sound research.

The researcher's goal is to differentiate himself from others and to become an expert at something that is dear to him and hopefully to others. This cannot be achieved if he finds topics that will lead to his writings being shelved only to collect dust. There has to be a motivation to change something in society, to bring forth new knowledge.

Most of the time, the initial research topic will undergo alterations over the course of the researcher's studies; this is normal and is part of his research process. The researcher must not throw anything away as it may prove useful later on.

Let us summarize: the researcher's research topic should comprise the following:

- Be meaningful to him and hopefully to others.
- Involve high stakes in a specific context (e.g., sexual predation).
- Require action (e.g., new, tougher punishment mechanisms).
- Or help him recognize that *status quo* is acceptable (e.g., the researcher finds that the current laws are protective enough of the vulnerable targets of sexual predators).

1.3 Multidisciplinarity

Researchers must accept to expand their interests in somewhat opposite directions: they will first dig as widely as possible into multiple disciplines in order to get as much information as they can on their emerging subject of interest (say, predatory marketing behavior) while at the same time, work with a very limited number of participants (starting with themselves)[3]. Bowlby (1973), the British scholar, created his theory of human attachment by comprehending the bond between mothers and their offspring in the animal world. As they progress, researchers will seek a larger number of participants operating in specific human activities all the while narrowing their focus.

For example, the researcher will start with a very small number of participants, and then increase the number; at the same time, he must cover as much theoretical

[3] See Klein 1990, 1996.

ground as possible and narrow his focus as time goes on. The procedure is the following (Fig. 1.1):

Researchers should begin by defining their concepts and by envisioning ways to measure them. Suppose the researcher's topic of interest is sexual or financial predation: he may want to look into how animal predators, in the wild, behave, prepare their plans of attack, collaborate with others of the same species, and deploy their strategies to kill their prey. After all, studies have compared stress reactions in animals and humans (e.g., see Hostinar et al. 2014). The researcher may then decide that predation can be measured, to start with, by identifying the predator, the prey, and the tool or strategy used to catch the prey. The researcher may start to describe the predator as someone who is cold, calculative, egoistic, and motivated by gain.

The researcher would then discuss these ideas with medium-sized groups, all the while narrowing down the focus to more specific spheres of human activity. If he has prepared a tentative questionnaire on the subject of sexual predation, he may want to pre-test it on a small number of individuals. Finally, with results obtained from distributing a final questionnaire to large groups, he would be able to run statistical analyses that will help him to better understand the links between the concepts used in his model (predation, vulnerability, etc.) in very specific environments or contexts (e.g., pedophilia).

The researcher, at this point, is free to look for new ways of seeing things. DSM-V (Diagnostic and Statistical Manual of Mental Disorders), for example, lists the following disorders: neurodevelopmental disorders: schizophrenia spectrum and other psychotic disorders; bipolar and related (mood) disorders; depressive (mood) disorders; anxiety disorders; obsessive-compulsive and related disorders; trauma- and stressor-related disorders; dissociative disorders; somatic symptom and related disorders; feeding and eating disorders; sleep–wake disorders; sexual dysfunctions; gender dysphoria; disruptive, impulse-control, and conduct disorders; substance-related and addictive disorders; neurocognitive disorders; paraphilic disorders, and personality disorders. He may want, for the sole purpose of developing a new line of thought, trying to organize these disorders according to the consolidated model of predation (CMP) elaborated by Mesly (2010 onward), which classifies seven key constructs in a certain order[4] (perceived predation (prey/predator); dependence; trust (emotion); equilibrium (cognitive); cooperation (conative); reward; and self, or, put in neurobiological terms (to list a few elements): perceived predation (prey/predator)—hypothalamus and HPA/HPG, cortisol, testosterone[5]; trust—amygdala, oxytocin; equilibrium—PFC; cooperation—Wernicke area, motor area, serotonin[6]; reward—VTA, dopamine. The researcher would then, to the best of his knowledge

[4] These seven constructs, including trust and cooperation, seem to be an integral part of the therapeutic relationship between therapist and patient in modern hypnotherapy (see for example Araoz 1982, 1985).

[5] For example, Terburg et al. (2009) note that the testosterone-to-cortisol ratio is a key indicator for proness to social aggression.

[6] For example, Riedl and Javor (2012, p. 73) note that testosterone and cortisol are typically associated with distrust and oxytocin and serotonin with approach behavior and trust.

and as a starting point to develop his investigative mind, allocate disorders to these seven constructs: those related to the predator–prey construct (schizophrenia spectrum and other psychotic disorders, paraphilic disorders); to emotions[7] (bipolar and related disorders, depressive disorders, anxiety disorders, obsessive-compulsive and related disorders, trauma- and stressor-related disorders); to dependence (substance-related and addictive disorders); to cognitive conditions (neurodevelopmental disorders, somatic symptom and related disorders, neurocognitive disorders); to social behaviors (disruptive, impulse-control, and conduct disorders); to reward (feeding and eating disorders, sleep-wake disorders, sexual dysfunctions); and to self (gender dysphoria, dissociative disorders, personality disorders). Not all psychologists will accept this way of looking at things, but the researcher is not longing for approval from others; he is merely playing with models and constructs in an effort to find his own interests. The above way of looking at disorders would allow the researcher to investigate possible links between them. For example, a recent research by Culhane et al. (2014) found that serial murderers deviate from social norms on more than one construct provided in the CMP: they experience a high level of persecutory ideas (prey construct), emotional instability (emotional-trust construct), and antisocial behaviors (social-cooperation construct)[8]. Thus, the researcher trying to expand on the CMP would try to better understand the links between these various forms of disorders: could one disorder, for example, influence the other? Additionally, he could dig into other theories (e.g., that of injuries) and try to make more correlations using the above grid: predatory/prey—victimization; dependence—rejection; trust—betrayal; equilibrium—injustice; cooperation—abandonment; reward—punishment; self—humiliation. He could also dig further into neurobiological bases for links between, say, the construct of equilibrium (fairness) and trust. As King-Casas et al. (2005, p. 82) note, for example "The caudate nucleus receives or computes information about (i) the fairness of a social partner's decision and (ii) the intention to repay that decision with trust." Further investigation aiming at opening up one's mind could look into personality types based on attachment theory (Mikulincer and Shaver 2007) with, for example the instrumental-hostile type pertaining to the predator construct, the anxious type to the trust construct, and fleeing/avoiding type to the cooperation (or lack thereof) construct. The researcher would want to investigate the link between cooperation and self-perception where the latter would at least partially equate with self-interest. As stated by Tomasello and Vaish (2013, p. 231) "Cooperation requires individuals either to suppress their own self-interest or to equate it with that of others." A good example of this is the requirement for patients to cooperate with their therapist during an hypnosis session (alongside a motivation to be subject to hypnosis).

All in all, the researcher will accept multidisciplinary research in the beginning; initially he seeks large theoretical grounds, and then, over the course of the investigation, he will narrow down his field of interest. He should not start small and conclude that the results of his research are most probably "generalizable." Suppose

[7] Watson (2005) argues that mood and anxiety disorders should be merged together.

[8] As is well documented, psychopaths ignore social norms (Hoff et al. 2009).

he focuses on the construct of self; he may, after debating Bandura positions about self-deception (Bandura 2011), decide that he ought to make a difference between self and perceived self, just as there is a difference between perceived predation and actual predation. After looking into both constructs, he would then narrow down his focus on "perceived self" alone; he would examine how people in various areas of human activities and animals seem to develop a "perceived self." He would then narrow down his area of interest further by examining only how paranoiac individuals (underlying a prey construct) perceive themselves. He would perhaps then be able to state that animals do not suffer from paranoia. Using multidisciplinarity, the researcher would frame his construct in a much more concise way.

It is hardly possible to have the right definition of a concept without personally speaking to participants and to some experts. Yet, it is impossible to know the strength of relationships between concepts without statistical analyses, which require a large number of participants. Talking to participants will lead the researcher to some ideas or constructs, for example that of vulnerability. But the only way to measure the strength of the correlation (e.g., an R^2 of, say, 0.56) between the strategy used by a sexual predator and the inherent vulnerability of her/his prey (e.g., a child) is by collecting data on a large number of people and run statistical analyses. This will be discussed in the chapter on quantitative research.

It is generally a good idea to do qualitative and quantitative research. More precisely, quantitative data may help enhance the findings of qualitative interviews (Frels and Onwuegbuzie 2013). Becoming an expert at dealing both with human situations/human beings, and number crunching is certainly of value.

Only through multi-informants and multi-methods will the researcher quickly speed his way to the finish line—completing an article or a thesis. He would have wasted no time in wrongly defining his concepts, making erroneous assumptions, or collecting treacherous information that lead to dubious conclusions.

1.4 Conclusion

Adopting the right attitude, finding that something that is of value to oneself and that could be of value to others as well are good starting points. There are many steps to be performed in terms of finding the right participants.

1.5 A Short Clinical Case

"In my private practice, establishing trust with the patient is fundamental. I achieve this naturally. Many patients have told me that when calling to inquire about therapy, a soft, balanced tone of voice has motivated them to book an appointment with the psychotherapist. Somehow, it generates trust and helps establish a good rapport

even before the therapist and patient actually meet for the first time." (Claire Poulin, psychologist 2014).

1.6 A Few Questions

A few questions	
The researcher's topic	What is it (one simple sentence: subject, verb, direct object)?
	Why is it believed to be interesting?
	What action will be generated by addressing this topic?

1.7 A few Tips to Speed Up the Research Process

The researcher must:

- Be intellectually honest.
- Be courteous.
- Not think he knows everything.
- Not build up complexity.
- Find words similar to his research topic (See Annex A).

Chapter 2
Bubbles and Arrows

2.1 Introduction

In this chapter, modeling and providing general principles of conducting research are discussed. This is part of the data percolation methodology that will be explained throughout this book.

2.2 Bubbles

Modeling is easy, but it requires practice and patience. A standard approach is to construct a model and try to justify it by borrowing from previous scientific writings, sometimes twisting interpretations and logic to make the model work or show the appearance of working. Another route, much less travelled, is to build up the model after doing the research, a methodology akin to or part of what is called grounded theory (Strauss and Corbin 2004).

The researcher should be able to conceive an initial model with the realization that it is only a work in progress and that it should and will most likely evolve. Not having a model to start with is an indication that he has not done his multidisciplinary inquiry into what is known about his topic of interest. Life is full of basic models. Here are some examples: (1) a patient's satisfaction with a clinic leads to referential; (2) increased expenses in publicity lead to higher exposure to potential receivers of psychological services; (3) there is a potential for attachment between a patient and her/his therapist (Holmes 1996).

To be sure, the model must be as simple as possible at the beginning. To do otherwise is unscientific because by adding complexities to it the researcher actually increases the number of variables he cannot control; hence, his conclusions may not be right or be assumed to be general enough or else verifiable. Unfortunately, many

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O. Mesly, *Creating Models in Psychological Research,*
SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5_2

scientific papers go on with overly complex models that no one can use in real life[1]. If one talks to the top chess players in the world, they will tell that they focus on about three scenarios (among the endless possibilities that the game of chess offers at each stage of the game) and on three strategies: time gain, position gain, and material gain. It is as simple as that. Models are a simplification of reality; they are not meant to make one's life more difficult than it already is. Ryan and Bernard (1994, p. 782) expand on this theme[2]:

> Regardless of the kind of reliability and validity checks, models are simplifications of reality. They can be made more or less complicated and may capture all or only a portion of the variance in a given set of data. It is up to the investigator and his or her peers to decide how much a particular model is supposed to describe.

The researcher accomplishes two things when he creates a model, even the simplest one[3]: first, he gives life to his topic, helping him to identify the kind of action it may eventually require or command. Second, the model will become the cement that he will use to build up his entire research project; granted, it may be emerging and changing but it is still of value as a basis for work. The researcher should name his model; make it his baby so to speak.

2.3 Bubbles and Arrows

Once the researcher has identified his key topic, it will become his favorite "bubble" (construct), towards which two kinds of arrows will point or from which they will spread out. *Bubbles* are for constructs; *arrows* are for the bonds between the constructs or bubbles.

There are the *constituent arrows* (*structural*—binary or continuous, as well as *functional*) that participate in a rather intimate manner in the definition of the researcher's concept (also called construct or variable) but which are not subject to time.

There are the *consequent arrows* which necessarily imply a temporal factor (see Goldfried and Davison 1994, p. 26); they come in three forms (*influence—I, longitudinal—T, and causal—C*). This will be discussed in detail later on.

In its most simple form, the model consists of only one bubble, as follows (Fig. 2.1):

All the researcher want to do here is define the construct (that of harassment in this case). Harassment is the main construct (and the only one in this case) of the current model.

---

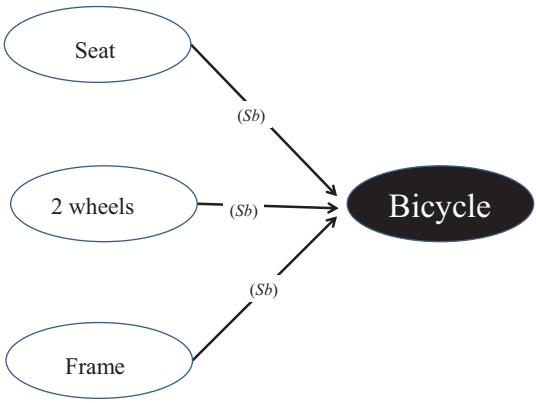
[1] See Jarvis et al. 2003.

[2] Olivier and Payette (2010, p. 18) about modeling: group of concepts linked together by some sense of coherence and definition, giving a simplification of reality.

[3] Brousselle et al. (2009, p. 60) explain that modeling is meant to make intelligible a complex reality not to make complex a simple reality!

Fig. 2.1 One bubble

Fig. 2.2 Three structural subconstructs forming a main construct



A single main construct can be *structurally* formed by *at least* two other constructs[4,5]. To better understand this, let us use the example of a bicycle (see Fig. 2.2):

In the above example, the three bubbles on the left merge *to form* (at least in part) the element on the right: they are *sine qua non* conditions for having the bubble on the right. If one sees only one wheel, it is no longer a *bi*cycle that is formed on the right side of this figure (the right bubble). The three bubbles on the left are what create the structure on the right (at least in part), *independent* of time. To show this independence from time, all three arrows point towards the *same point* along the bubble on the right.

This can be put under a real life perspective involving a concept, that of harassment. Under the Quebec law, in order to prove harassment, there must be evidence of each of the following four elements (they are thus *structural* concepts) being present, as per Fig. 2.3:

One cannot say that repetitive behaviors *lead to* harassment; this is not a causal relationship. The bond is a *structural* one in particular and a constituent one in general. All four elements are needed to form harassment. Take one out and one can no longer conclude that there is harassment. An example from psychology is the construct of effective hypnotic session; according to some authors (e.g., see Golden et al. 1987) it requires benevolence, authority, pacing (matching the patient's

[4] The term structural is not related to structural equation modeling (SEM).

[5] The reason why we need at least two subconstructs to form a single construct stems from the fact that we want define construct by what it is and what it is not (black and white). Therefore, a construct is necessarily formed by *at least* two subconstructs.

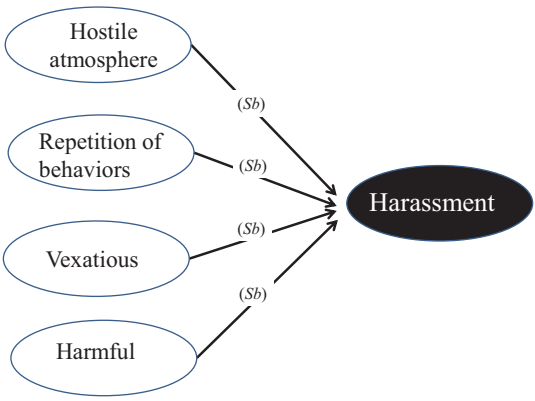


Fig. 2.3 Structural elements forming the construct of harassment

tempo), and joining (being flexible with the client's needs and expectations). These would be structural variables if they were *sine qua non* conditions to "effective hypnotic session" and if they were each completely independent one from the other (the concept of pacing, for example, is completely independent from the concept of benevolence).

The researcher can already see how important it is to define his concepts correctly from the beginning. Suppose he forgets one such key structural element out of his core concept (e.g., he forgets "pacing" from "effective hypnotic session"); well, he may spend 4 years doing research that is incomplete. This is why it was important to dig into the literature of multiple disciplines and that he understands his own limitations from the start before going out there and talking to strangers (the participants) or before sitting behind a desk and sending questionnaires with the hope of receiving enough back so as to run some statistical tests. As an example, it has been found that harassment actually may come in different forms at the same time (ethnic, access, treatment, microaggressions, etc.,—see for example Raver and Nishii 2010), so that looking at sexual harassment alone may not provide a complete picture of what the victim is actually enduring.

As one can see, the above case has nothing to do with time. Truly, the four bubbles at left are structural *sine qua non* components of the construct on the right. If anyone of these four elements was not found in the case of John Smith against Jane Doe, a jury would conclude that there was no harassment and the accused would walk free.

A final word on structural arrows: they come in two forms. To be more precise, there are two ways of measuring the bubbles (constructs) they emanate from. It could be enough to determine whether the bubbles on the left (the structural elements) are present or not. This is binary measurement with 1 = present, 0 = absent. For example, in the consolidated model of predation (CMP) and more precisely when it applies to sexual predation, there are five necessary conditions to claim that predation takes place: (1) a predator (yes/no); (2) a prey (yes/no); (3) a tool (yes/no); (4) an injury (yes/no); and (5) a surprise effect (all sexual predators inflict damage on a prey with a tool …by surprise) (yes/no). Should anyone of the five

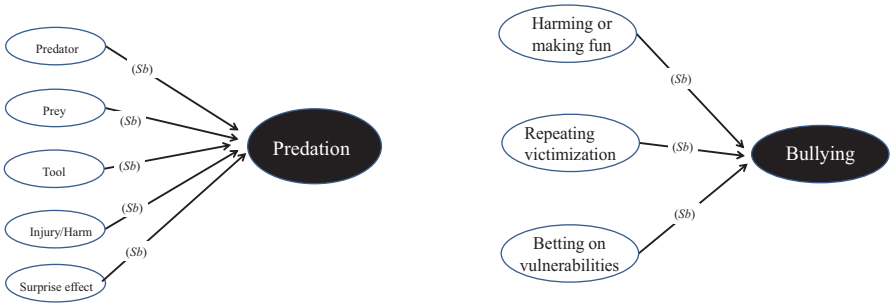


Fig. 2.4 Structural binary elements (*Sb*) forming the main construct of predation and bullying

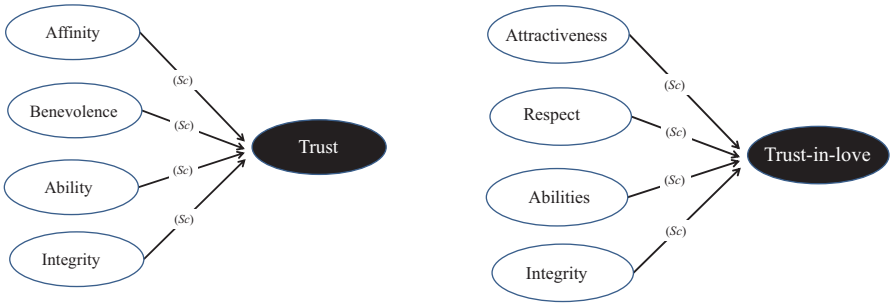


Fig. 2.5 Structural continuous elements (*Sc*) forming the constructs of trust and love

elements be missing, one cannot claim there is predation. Predation is necessarily defined by the simultaneous presence of the five essential elements. Graphically, this is represented as follows (Fig. 2.4):

In the case of bullying (see Olweus 1993; Juvonen and Graham 2014), it is structurally formed of physically harming or making fun of someone, repeatedly victimizing her/him, and abusing one's power (betting on the other's vulnerabilities).

Note how each arrow points to the same point on the main construct (predation). Note that the term (*Sb*) is put on the arrows to signify that these are binary components: for all intents and purposes, the researcher does not need to know the specific of, say, the predator (e.g., her/his exact profile), all he needs to know for now is whether the predator is present (1) or absent (0).

Structural components could also be used (in fact, they are generally constructs in their own right); they are measured on a continuous scale, such as a *Likert scale* ranging from 1 to 7 (from "not at all" to "completely" for example). In this case, the symbol (*Sc*) is used. In the case of the CMP, trust is necessarily composed of four *subconstructs,* which could be measured on a continuous scale (it appeared insufficient to simply measure them by their presence or absence). Figure 2.5 expresses this:

Again, one should note that the arrows point to the same spot along the right bubble and that they are not subject to time. It could well be that each bubble on the left (such as affinities, benevolence, etc.) is in turn formed of a series of structural components (sub-sub-constructs) which would contribute to make the model more complex. The important point is that by working his way through such a modeling approach, the researcher really defines his constructs and establishes where the limits of his definitions are[6]. This allows him to see what components or constructs (or put otherwise, variables) are worth investigating further. For example, if he wants to know more about trust, he must necessarily inquire about its structural components (e.g., benevolence), which are concepts in their own right and which in turn could command their own investigation.

In the context of a loving relationship, one could imagine a model where "trust-in-love" would have four slightly similar subconstructs: attractiveness (instead of affinities), respect (benevolence), abilities, and integrity. Love implies mutual trust (it also demands care for and need for—see among others: Steck et al. 1982). The model requires that if one takes any one of these variables out, there cannot be trust and consequently, any true love.

The researcher now sees why it is of utmost importance to keep his initial model as simple as possible. He also sees how identifying the type of bond between the various components of the model (structural—binary or continuous) guides him towards what he should be looking for in his research.

There is one possibility for a little bit of flexibility in the structural arrows. It has been stipulated that the left bubbles (they are on the left in the above examples, but because they are not subject to time, they can be anywhere around the main bubble) should be *sine qua non* conditions for the definition of the bubble on the right. However, one cannot always be sure that the definition is complete. Take the bicycle as an example: one knows it is not only formed by the seat, handlebar, and two wheels. A bicycle also has a frame, a chain, brakes, etc. But in real life, it is sometimes hard to know that one has completed the model. Thus the researcher can somewhat temper the rule by allowing some flexibility in the use of (*Sb*) and (*Sc*). He does this by using a small s, as in (*sc*) and (*sb*).

The small (*sc*) and (*sb*) indicate that the researcher may not have completed the definition (or the formation) of the main construct. They indicate that bubbles on the left may not, after all, be *absolutely* necessary to the definition of the bubble on the right (although, ideally, they would). Take the image of a town for example. The researcher could decide that the image of New York (the Big Apple) is formed of the Statue of Liberty, Wall Street, the Empire State Building, Ground Zero, and so forth. But he could focus on other aspects: the average age of the population, the average income, etc. There are so many things that form the actual New York. For example, psychopaths are known to be cold (without empathy), calculative, egoistic, and sneaky (see in particular Hare 2003). But perhaps there is a fifth dimension that describes their personality such as, say, being deceitful. The researcher would be inspired by the big five personality traits which he would try, for example,

[6] Bollen and Lennox (1991, p. 308): "Omitting an indicator is omitting a part of the construct."

to correlate to the above psychopathic traits: openness (cold), conscientiousness (calculative), extraversion (?), agreeableness (sneaky), and neuroticism (egoistic). He would use the code (*s*), indicating that deceitful (in an attempt to match it with "extraversion") is possibly a fundamental trait of psychopaths until he decides, after having done some research, that he ought to consider deceitfulness as part of being sneaky. The researcher would need to focus his attention on one particular point of view, and use small (*sb)* and/or (*sc*) to let know of the fact that the construct of deceitfulness (the main construct) is not yet fully determined. At least, he lets his reader know that he is aware that his definition is incomplete. Ideally, the researcher wants to aim for (*Sb*) and (*Sc*).

Not all constructs, components, variables are born equal. The researcher's modeling effort is a judgment call that only he can make.

2.4 Other Types of Constituent Arrows

There are other types of constituent arrows. It has been seen that the constituent arrows come in one type, that of structural arrows[7] (they *form* the construct of interest; they are essential to its definition). But there are constituent arrows that come in another type as briefly mentioned above: functional. They do not form the construct; they are an expression (with no time involved) of the construct.

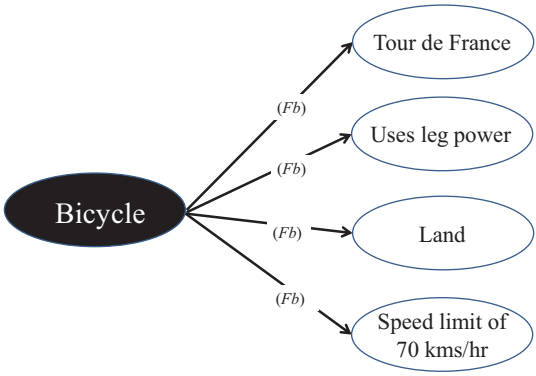
Let us use an example: cooperation—the capacity to work with others. Cooperation is an action, unlike trust, which is more like a sentiment. Actions can be seen. So the researcher does not define cooperation by its components (structural variables) but by its manifestations (*functional* variables, with both structural and functional variables being constituent variables implying constituent arrows).

In the context of a dyad involving a patient and his behavioral psychologist, cooperation could be inferred by four elements: (1) flexibility (e.g., on the part of both individuals); (2) exchange of information; (3) joint problem solving; and (4) an orientation towards the other (wanting the best for the other person). But one can still infer that there is cooperation even if the clinical psychologist is completely inflexible; she/he still provides the required information and conducts the therapy session. So, under functional arrows, the variables (or components or constructs in this case) do not have to be *sine qua non* conditions. Additionally, they do not form the construct of cooperation; rather, they are an example of it, a fundamental manifestation of it. It is through the manifestation of flexibility, exchange of information, joint problem resolution, and orientation that the researcher can *infer* that the psychologist is cooperative. The more of them, the more he feels justified to infer that there is cooperation (Fig. 2.6).

So, the arrows go from the main bubble (that of cooperation) towards other bubbles (using functional arrows—*F*), as exemplified in Fig. 2.7:

[7] Structural variables are akin to formative variables in psychological statistics (Diamantopoulos et al. 2008).

Fig. 2.6 Bicycle



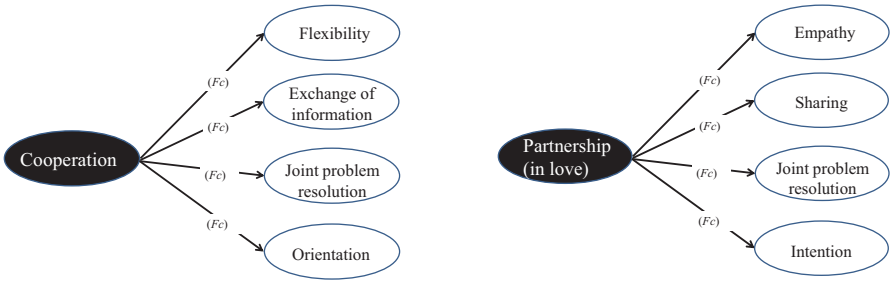


Fig. 2.7 Functional arrows (*F*): cooperation and "partnership" with their four subconstructs

Flexibility does not *form* cooperation; it is a *manifestation* of cooperation. When the researcher notices that Ms. Smith, a clinical psychologist, is flexible and responsive to a patient's needs, he infers that she is cooperative. Is she proving that she is cooperative? Yes, so the underlying construct is cooperation. Can she still be perceived as cooperative even if she shows no flexibility (but shows instead, for example, lots of information handling)? Yes, so flexibility is *not* a structural variable of the cooperation construct.

One can use the same approach with the construct of love, within which "cooperation" would be replaced by "partnership." Partnership, within the framework of love, is expressed by some level of empathy (flexibility), sharing (exchange of information), and joint problem resolution or intention (e.g., the intention to live together). It may be that the couple does not experience problems which require some joint problem resolution at the moment, but when major difficulties occur, the fact that the couple is able to deal with them is a sign of partnership.

There is a huge difference between structural variables (akin to formative variables in statistics[8]) and functional variables (akin to reflective variables). In par-

[8] See Diamantopoulos and Winklhofer 2001; Diamantopoulos and Siguaw 2006.

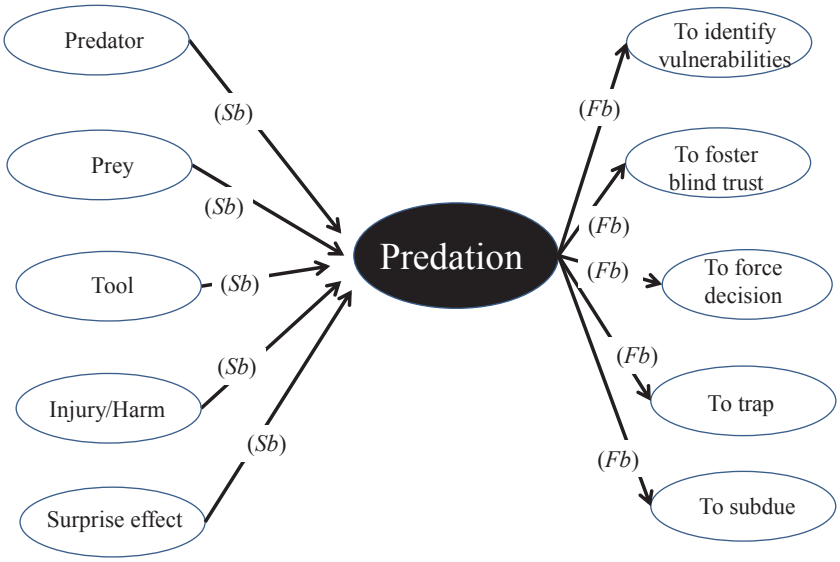


Fig. 2.8 Structural (*Sb*) and functional (*Fb*) *arrows* in the consolidated model of predation (CMP)

ticular, unlike structural variables[9], functional variables have generally high levels of colinearity (which will affect such statistical analyses as regression—hence, one generally does not perform regressions on functional variables without accounting for colinearity). One of the reasons there are high levels of colinearity between the functional variables is that they often work together like a clock mechanism: flexibility will somewhat transpire in the way one exchanges information. Immediately following some fruitful exchange of information, the customer will become more responsive and show some flexibility, which the salesperson perceives as being an effort at cooperating and so forth. Similarly, empathy often works hand in hand with sharing. As the patient feels he receives empathy from her/his therapist, she/he becomes more willing to share her/his deepest thoughts.

Sexual predation, to take this example, can be considered to be formed by five structural components (that can be measured on a binary scale) and is manifested by five strategic steps which can all work together like a clock mechanism over a short period of time (so short it can be assumed that time is not a factor for all intents and purposes); hence, one obtains what it called the 5/5 principle or else the predator web (Fig. 2.8):

By creating the right model, the researcher clears his mind of the mess that would lead him to construct wrong measures.

Running a multiple regression with functional variables is very risky because of the inherent high colinearity among the functional variables. On the other hand,

[9] Collier and Bienstock (2009, p. 284) mention that formative variables in statistics are theoretically uncorrelated or sometimes negatively correlated.

Table 2.1 Constituent bubbles and arrows

Do	Don't!	Comments
Start identifying constituent arrows (and variables)		
Structural (*S*)	Doing a regression without independently measuring the main construct	Binary (*Sb*)
	Boosting Cronbach's alpha	Continuous (*Sc*)
		Temporary (*sb* or *sc*)
Functional (*F*)	Not recognizing high potential for colinearity	Binary (*Fb*) or continuous (*Fc*)

betting on high Cronbach's alpha is easy, but not necessarily the wisest thing to do with structural variables, as it will be discovered later in this book. Note that the (*F*) is used to identify functional arrows (so that the reader does not think these arrows are temporal) and note that all (*F*) constructs are measured on binary or continuous scales just like (*S*) arrows.

This provides further evidence that a model must be as simple as possible. If it becomes too complex, it must be broken down into submodels.

So let us summarize. One can have a model with one bubble. To this bubble, structural arrows can point (with their structural variables being measured binary or continuous), and from this bubble, functional arrows can depart (with their functional variables always measured on a binary or a continuous[10] scale such as a 7-point Likert scale, starting with the lowest score at zero because the functional variables are nonessential).

Let us put this in a table (see Table 2.1):

To define a construct fully, the researcher needs both sides of the equation: he must identify the structural *and* the functional variables.

2.5 More Bubbles

A two-bubble model that is commonly found in psychology is the following (Fig. 2.9):

One could also have more than two bubbles in a row (see Fig. 2.10):

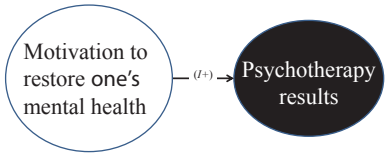


Fig. 2.9 Two-bubble model

[10] "Continuous" in the sense that it is not binary. In a true sense, the scale is not continuous but 'elongated' although the measurement could be continuous. For all intents and purposes, we use the term 'continuous'.

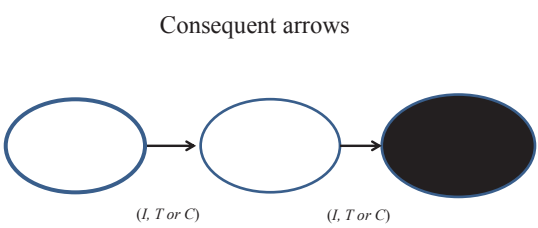


Fig. 2.10 A chain of bubbles

Fig. 2.11 A chain of bubbles

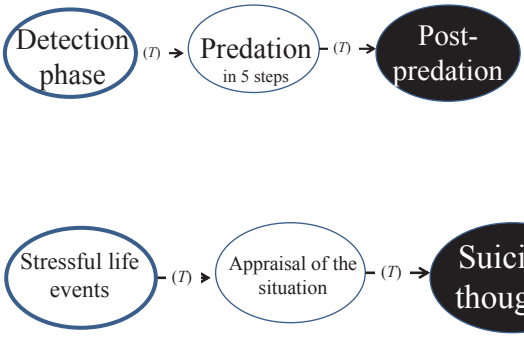


Fig. 2.12 Predatory chain

These are consequent bubbles, where *time is a factor*. As a rule of thumb, the factor time is assumed to travel left to right; so here, for consequent arrows and bubbles, bubbles must follow their sequence from left to right.[11] The researcher does not know yet if the bubbles on the right are an effect of the bubbles on the left, but he knows that time is a factor. As mentioned above, consequent arrows come in three formats (*I, T*, or *C*) which will be discussed further along.

Let us go back to the sexual predation model. At some point, there is a prepredation stage (during which, for example, the predator detects his prey—innocent children playing in a park) followed by a pure predation stage (with its five steps as shown in Fig. 2.7.) The whole predatory scenario ends with a postpredation phase—for example, the child's parents realize their child has disappeared. Figure 2.11 puts this graphically:

Reverting to the way of indicating the nature of arrows, one can redraw the above as follows (Fig. 2.12):

[11] Creswell (1994, p. 85) mentions: "Position the dependent variable on the right in the diagram and the independent variables on the left."

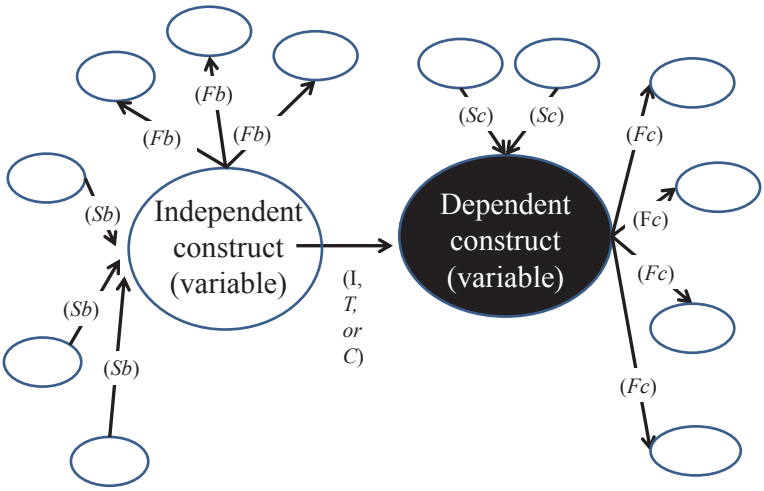


Fig. 2.13 A complex model in the making

As can be seen, a similar model is that of Johnson et al. (2010), dealing with self-predation (suicide). In this case, stressful life events lead to an appraisal of the situation which then leads to suicidal thoughts. Golden et al.

(1987, p. 9) provide another example by listing the five temporal stages in hypnotic treatment: "(a) preparation of the client for hypnosis, (b) hypnotic induction, (c) deepening of techniques, (d) utilization of hypnosis for therapeutic purposes, and (e) termination of hypnosis."

So the main recommendation here is to break the model down into submodels as soon as it becomes too complex. Studies have shown that most people rely on a maximum of three, and at times four pieces of critical information to operate, decide, and live. Not more. The researcher should always identify the types of arrows he is dealing with (*Sc, T*, etc.) even if computers do not know (yet) this language.

Here is an example of how quickly a model becomes complex (Fig. 2.13)

2.6 Conclusion

Understanding constituent and consequent bubbles and arrows is the key to modeling.

2.7 A short clinical case

Based on my 32-year experience as a psychologist, I can say that there can't be an effective therapy session without mutual trust. There are many ways to establish trust, and often, I can sense if a patient is serious about his willingness to persevere with the therapy or not.

Similarly, patients who call for the first time and book an appointment soon decide whether they feel I am trustworthy or not. From this perspective, mutual trust is a structural component of an effective therapy session. (Claire Poulin, psychologist, 2014)

2.8 A Few Questions

A few questions	
Model	Have the bubbles and arrows been identified?
	Are the structural arrows/bubbles (*S*), identified, even tentatively?
	How about the functional arrows/bubbles (*F*)?
	What name was given to the emerging model?
Simplicity	Does the researcher thrive on "complex complexity"?
Self-assessment	Has the researcher gone through some form of self-ethnography?

2.9 A Few Keywords

A few keywords	
Bubbles	A construct in its figurative form
Constituent bubbles	One construct (variable = bubble) is linked to another. Can be expressed through structural *(S)*—binary or continuous, or functional *(F)*—binary or continuous arrows. No time factor
Structural arrows	Structural arrow that expresses the fact that there is a *sine qua non* condition to the definition of the main construct; this condition is expressed by at least two subconstructs. Minimum: 2. No time factor
Functional arrows	A functional arrow expressing the fact that the subconstruct is not essential to the definition of the key construct, but that it is a key manifestation of it. The main construct can be inferred from the functional variables. Minimum: two variables (subconstructs). No time factor
Consequent bubbles	Constructs that imply a time factor. Expressed in three forms (influence—*I*, longitudinal—*T*, or causal—*C*)

2.10 A Few Tips to Speed Up the Research Project

The researcher must:

- Understand his constructs and topic
- Identify bubbles and arrows
- Not seek complex models, names, titles, constructs
- For the structural variables, ask: "Can the construct exist without the structural variable being present?" If not, then the variable is indeed a *sine qua non* condition and thus it is a structural variable.

- To ensure that the structural variables have no colinearity (in which case they are functional variables), the researcher takes the first structural variable and asks: "Is this structural variable fundamentally different than each one of the other structural variables pointing to the same construct?" If yes, then it is a structural variable indeed. The researcher then asks the same question for each of the other structural variables.

Chapter 3
Basic Principles

3.1 Introduction

More principles are proposed and an additional foray into modeling is provided.

3.2 The Hypothetico–deductive Method

The researcher should not start putting up hypotheses around his emerging model yet—it is too early. His model is like a baby—let it reach maturity before the baby is asked to go to Harvard. The researcher should also know that in many articles he reads, the model he sees was actually created *after* the results were obtained, so it would fit the data.[1] Some people admit to it as it is a reality of academic life. At least with his proposed methodology whereby he builds his model as time goes on, the researcher will never be accused of falling into this trap. This does not mean that he cannot formulate various assumptions[2]; he is still in an inductive stage and not yet in a hypothetical–deductive stage. Figure 3.1 shows where he is standing right now.

It is perfectly acceptable to resort to inductive reasoning and intuition. First and foremost, the researcher is searching for sensemaking.[3] He should eventually use the hypothetico–deductive method, but this requires a large number of participants (approximately 135–200 at the very least).

[1] See Cossette (2007) and his idea on cooking up results and models, after he did research on the subject (p. 8).

[2] See Emory (1985, p. 26–27).

[3] See Paillé and Mucchielli (2003, p. 9).

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O. Mesly, *Creating Models in Psychological Research,*
SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5_3

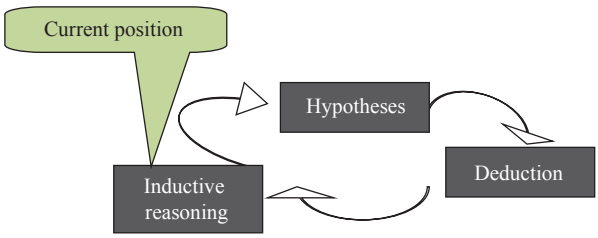


Fig. 3.1 A road map to building a model

3.3 Is Black or White?

It is far too early for the researcher to start discoursing on hypotheses as his key constructs have not yet been fully defined, despite the fact that he has identified at least some of the structural and functional variables.

The researcher has to define an object by what it is and what it is not. This helps delineate the area of investigation.[4] It is also proof that he has thoroughly researched his topic.

It is important that he be able to say: "I researched the color white and I have discovered that white has the following properties: it is composed of a spectrum of colors that have the following wave lengths, etc. But there is more: I have also discovered, along the lines of authors so and so, that white is not black for the following reasons… I have decided to focus my attention on white, not black…"

It is crucial that he defines his core construct with what it is and what it is not. Remember that progress agrees with the contrasting ideas.[5] In order to find contrasting cases, the researcher must dig into as wide a research environment as possible—this is considered a superior approach[6].

3.4 Observables

To define constructs, the researcher must observe. What does he observe? He observes ***"observables"***.[7] An observable is something one can observe! Something one can see, hear, and touch. Can the researcher observe love? No. Love is a con-

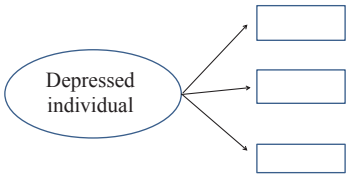
[4] The researcher should try to find as many ways to define his topic as possible. For example, here are some descriptors that Ribstein gives to the same financial predators (2002–2003, p. 9): "Machiavellian, narcissistic, prevaricating, pathologically optimistic, free from self-doubt and moral distractions, willing to take great risk […] obsession […], intense".

[5] "… Science progresses through the accumulation of multiple confirming instances obtained under a wide variety of circumstances and conditions" (Anderson 1983, p. 19).

[6] "…obtaining data from multiple informants has been recommended as superior to such an approach" (Wieseke et al. 2008, p. 324).

[7] Multicriteria analysis uses the term "observable" and even recognizes that some phenomena are not observable, like thoughts.

Fig. 3.2 Observables



struct because it is not observable. What he can observe are behaviors that lead him to infer that love is present: two students in a public park constantly look each other in the eyes, touch hands, kiss, etc. All of these things are observables and are a pretty good indication that love is present. Gilbert (1992), for example, gives the following observables for parental acceptance: physical—kisses, hugs; and verbal—praise.

An observable is a behavior; it has movement. The Beck inventory is not composed of observables but rather of states of mind. If, instead of having a question asking whether the respondent feels his life was a failure or not, the question was: "I had x number of failures" (which could be counted and proven with facts), then these would be observables. What the researcher really observes is the change, the movement, not a construct or state of mind or an assumption about a state of mind. An observable is a movement that can be observed, that can be heard or filmed. Observables are behavioral expressions of structural or functional bubbles.

As a rule of thumb, they are represented as follows (Fig. 3.2):

Observables are graphically depicted by rectangles (never by bubbles, circles, rectangles with rounded corners, triangles, pentagons, etc.); there is a minimum of three observables per construct; and the arrows all start at the same point (because observables are not sensitive to time in relation to the construct they refer to). The researcher wants a minimum of three observables. In case two observables do not seem to agree on how they allow him to infer the latent construct, the third observable will resolve the debate just like a third judge would seal the decision on the winner in a boxing match after the first two judges arrive at a split decision.

Let us take anger, or more precisely an angry individual. How will the researcher know that there is an underlying construct of anger for this individual? By finding meaningful and measurable observables such as red face, aggressive tone, and pointing a finger. The researcher is not likely to conclude that the individual is happy if he sees these behaviors (these movements). Let us take a happy individual: he has a big smile on his face, he walks with his back upright, etc.

These are observables.

There is an additional level in the hierarchy of bubbles and observables, which is the level of clues. Clues are used mostly in forensic and anthropological studies. Judging from materials found at a scene, the forensic expert can start inferring behaviors, and then motives (a construct in itself). Similarly, archeologists look at mummies in Egypt and can infer the likelihood of Nefertiti being the possible biological mother of Tutankhamen and of having been assassinated by an archrival.

There are two types of observables. ***General observables*** pertain to a general context; for example, it is fair to assume that most, if not all, people smile when they

are happy. But the researcher can also use ***specific observables***, which pertain to a specific context. For example, in extreme fighting sports, it is customary to bump chests to show victory; however, in a daycare center, it could be interpreted as a gesture of confrontation.

Unfortunately, not everything is observable (and some things can only be observed at a very high cost, such as using functional magnetic resonance imaging (*f* MRI) to detect a change in the brain in order to infer that a situation has affected the participant—this is referred here to ***micro-observables***). A suicidal intention is not observable per se; hence, it is a very poor construct. The researcher could try to measure it by looking at the number of times Mrs. X, the suicidal patient, talks negatively about life, or the number of times she visits the gun store on an exploratory mission, or the number of times she clicks on relevant web sites. But these are rather difficult to measure and there is no guarantee that they really measure what the researcher wants to measure. Finding meaningful and measurable observables is a big challenge, yet it is absolutely necessary. From the observables, questions will be generated to become part of qualitative and quantitative studies using general or specialized questionnaires.

The researcher also runs the risk of participants trying to please him[8] or trying to hide the truth when filling out a questionnaire; when the researcher observes, he can reasonably rest assured that the participants are not cheating (if they do not know he is observing them).

So the next big step after the researcher starts building his model is to make sure that his constructs can be related to meaningful, measurable observables. If not, it is a pretty good sign that his model does not stand firm and that his constructs are poor (they may be good, but poor from a research perspective).

By definition, observables are functional, as they are nontemporal expressions of the construct. This is important to keep in mind when the time to run statistical analyses comes. For obvious reasons, the researcher does not need to find observables for binary structural bubbles (bubbles that use (*Sb*) arrows).

When he starts drawing observables around his initial constructs, his model will quickly become complex. See Fig. 3.3 as an example.

In the above example inspired by the works of Sylwester et al. (2013) discussing punishment at individual, group, and culture levels, a negative life capital is *formed* of three bubbles (individual, familial, and social capital) through structural arrows and each one of these three sub-constructs can be measured with at least three observables (do not use more than 9–13 observables; more than that would be unmanageable—one has to be able to visualize them all at once). In turn, negative life capital is measured by observables such as delinquent behavior (in a specific context, it could be further characterized, for example, by the breaking of a bottle of beer in the street during a riot) and drug use. A vice grip has been put around the concept of negative life capital.

Once the researcher has identified the meaningful and measurable observables, he will be able to construct qualitative and quantitative questionnaires.

[8] What is called the Hawthorne effect.

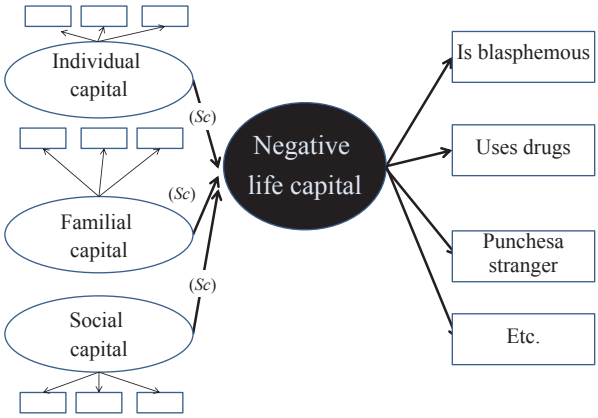


Fig. 3.3 Possible observables

Suppose he collects a vast number of observables for his construct of predilection (with a minimum of three) and he does not know what to do with them. Here are a few tips that can help: he can conduct more observations on larger groups with the hope that some observations are found irrelevant, keeping only those that seem to be universal or consistent. Alternatively, he can merge some of the observables, estimating that they mean essentially the same thing. He can also try to connect these to some existing theory. For example, it may be the case that his observables fit well into an existing model, such as the Interest–Activity–Opinion or the perceived threat models. Finally, he can see if the observables belong to a sub-construct instead of to the main construct.

Once he starts identifying observables and testing them in the field with structured or unstructured interviews, he knows he is deeply rooted in reality, and he knows he is starting to talk the same language as the participants (who should validate his effort and final results).

One fundamental rule, as far as observables are concerned, is that the researcher should be able to express them with one subject, one verb, and one object at most (at times, an adverb, or adjective may be necessary).

3.5 Conclusion

The researcher should develop his skills for finding meaningful and measurable observables and expressing them properly.[9] Modeling and listing observables is where he starts showing and proving that he works rigorously.

[9] Nunnally and Bernstein (1994) identify five key criteria for questions (that derive from the observables). They must be: (1) meaningful; (2) relevant; (3) measurable; (4) objective; and (5) not linguistically inflated!

Let us turn now to a methodology called ***data percolation***. The next chapter digs deeper into this exciting subject starting with why it is necessary: models quickly become very complex. There are many differences between data percolation and triangulation,[10] even in its most advanced form.[11] To start, triangulation is essentially a post-research technique for analyzing data.

3.6 A Short Clinical Case

"In the course of my practice, I regularly come across significant changes in behaviors as the therapy session develops. For example, a patient may walk in my office and talk with a loud and energetic voice, his shoulders proudly occupying space, his discourse fast and self-confident, and his hand movement being both eloquent and matching his high spirits. However, as we dig deeper into his real emotions, the voice becomes more subdued, the shoulders fall, the hand gestures slow down and diminish in scale, and his eyes seem to focus more on the inside than on my presence. These are all observables that allow me to infer that the patient has moved from a posture (construct) of self-control to one of self-assessment that is filled with emotional experiences." (Claire Poulin, psychologist 2014).

3.7 A Few Questions and Definitions

A few questions and definitions	
Observables	"When I was a kid, how did I know my parents were mad at me?"
List of words	Has a list of words, authors, and theories that are closely associated with the researcher's key constructs been made?

3.8 A Few Keywords

A few keywords	
Observable	A physiological and/or behavioral change that can be detected and measured, and that is meaningful to the underlying construct, being its representation. Minimum of three per construct. Preferably in odd numbers. Maximum 13. They can be general or specific

[10] Hall and Rist (1999, p. 297) refer to four types of triangulation: data, researcher, theory, and method.

[11] Robson 2002, p. 174.

3.9 A Few Tips

The researcher should:

- Start drawing bubbles
- Pull out his arrows
- Describe his model in as many ways as he can think of
- Describe his core constructs in as many ways as he can think of

Chapter 4
Building Complexity

4.1 Introduction

Data percolation is many things at once—a way of thinking, a series of steps, and a way of analyzing phenomena.

4.2 Building Complex Models

So far, a considerable amount of time discussing modeling has been spent, yet there are more types of bubbles and arrows to come. But with what is known one can already see that the researcher can start building some pretty strong models. Here is an example. Attachment is a key concept in psychology. One can reasonably assume that a child who is attached to his mother will seek her love—if he has enough motivation to do so, i.e., if he has a need. This situation can be portrayed as follows (Fig. 4.1):

In the above example, the variable(s) on the left influence(s) the variable on the right. Tajfel et al. (1971) argue that intergroup discrimination (lack of attachment in a sense) is influenced by four variables: (Influence 1) random assignment of group members; (Influence 2) limited or no communication between group members; (Influence 3) group members not knowing other members either in their in-group or the out-group; (Influence 4) group members showing no vested interests in being associated to their group. Note how the arrows do not focus on one particular point on the right bubble—influence is not a structural concept, but a temporal concept.

Going back to attachment, how does one determine attachment? One infers it. If the child comes back home from school instead of running away, one can say that he is somewhat attached (perhaps dependent, too scared to flee; whatever the reason, he is still attached at some level) to his mother. Therefore, intention to return home after school is a manifestation of attachment; it can be seen as a functional bubble

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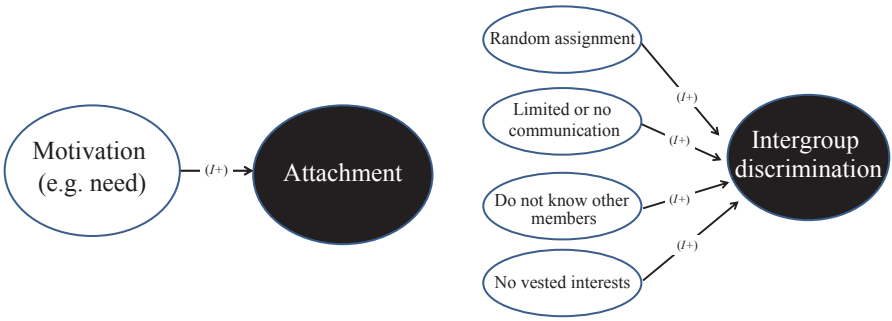

Fig. 4.1 The mechanics of attachment and intergroup discrimination

(a bubble that uses a functional (*F*) arrow). Need may *cause* the intention to return home, but it will *not cause* attachment. Attachment could have other functional bubbles. What do children who are attached to their mother do? Yes, they return home from school, but they also develop an emotional bond to their mother (dependent), which will make them talk about her to their friends, or cry for her when they hurt themselves upon falling on the ground, etc. (that's an observable). Additionally, they show considerable trust; should something go wrong in their life, they will readily confide to their mother, and seek her care and possibly advice. So there are possibly at least three functional bubbles for the concept of attachment—intention to maintain the relationship, dependence, and trust. Each could have observables, such as returning home to be fed. In the end, the researcher would need at least three observables per bubble (Fig. 4.2):

If the researcher wanted to find out what the meaningful and measurable observables were for the intention of maintaining relationship, dependence, and trust (at least three observables for each), he could infer them from the strength of the attachment the child has towards his mother (which does not mean that if the child

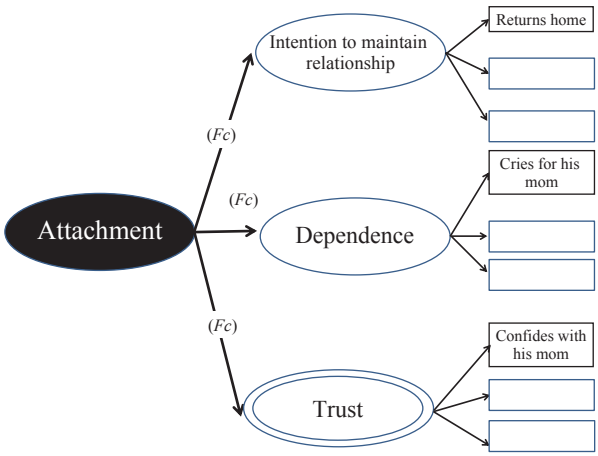

Fig. 4.2 The mechanics of attachment—Part II

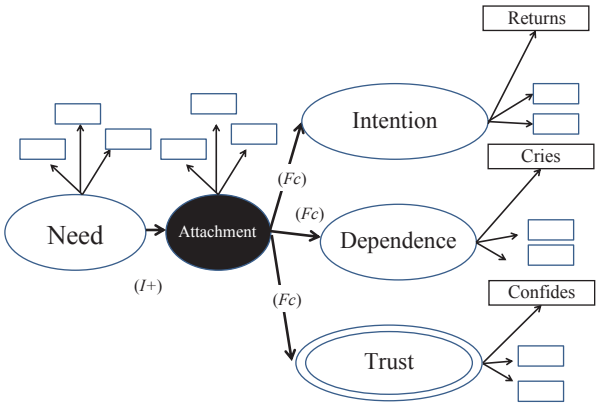

Fig. 4.3 The mechanics of attachment—Part III

has a need, he will necessarily go to his mother). In fact, the behavioral component (the *act* of returning home), the emotional component (dependence), and the cognitive component (mental choice inferred by trust[1], i.e., the belief the mother will not capitalize on the child's vulnerabilities) *form* attitude (are structural variables of attitude); thus one could say that from this perspective, attachment has a *functional connection to attitude*. It is one way of looking at the concept of attachment that the researcher would want to investigate, as an example.

But what "leads" to the attachment? It starts with the child's need; therefore Figs. 3.3 and 4.1 can tentatively be merged; the researcher can assume attachment is fuelled by a motivation (see Fig. 4.3)

In Fig. 4.3 (above), need influences attachment. But the researcher could devise another kind of bond following some preliminary research. He could argue that there can be no attachment without a need to be with the mother. Need would then be a structural component of attachment (it would require a structural arrow between the bubble motivation and the bubble attachment). No need, no attachment. Yet, a child may be attached to his mother without having a very strong emotional bond towards her.

But does this mean having a particular motivation—a need—is enough to turn a child into a highly dependent child? Perhaps it takes more (remember one needs at least two subconstructs to define a construct from a structural point of view). The researcher may think in requires absence of sibling competition and so forth.

The researcher could continue building the model as follows (Fig. 4.4):

The researcher could find observables for need (for example, the child is getting impatient when not fed). It is like a Lego structure. There are a few advantages to it. First, the researcher can see how he could simplify it; he could regroup the last

[1] Note how the construct of trust has a double oval (two bubbles). This indicates that it is actually composed of sub-constructs, which we have seen previously (Fig. 2.5): affinities, benevolence, abilities, and integrity. If anyone of these four sub-constructs had been found to be formed of sub-sub-constructs, then the representation of this scenario in Fig. 4.2 would be made by having three ovals (bubbles) around "trust." Hence, the number of ovals indicates the depth level of the construct.

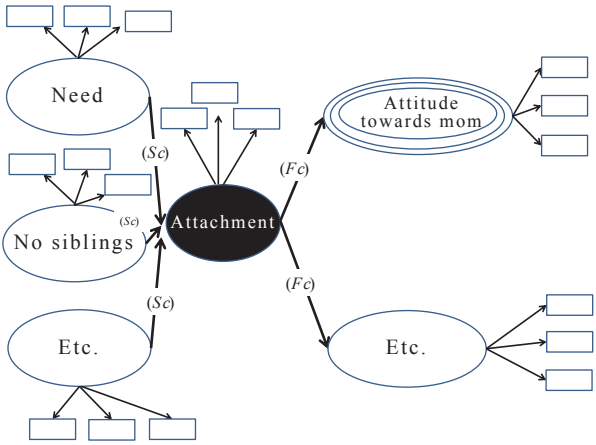

Fig. 4.4 The mechanics of attachment—Part IV

part on the right under a big bubble called "attitude[2]." Second, he gets a much better understanding of his constructs right up front. Third, he can look at things going left to right or right to left. For example, he can imagine that given a certain level of need, he could end up having the child eventually talk enthusiastically about his mother. Conversely, if the researcher observes a child who never cheers his mother upon her arrival to the school, he may infer that he has, somehow, a low level of need towards being with his mom.

This methodology is akin to forensic science. Given the right model, the researcher can travel in time and see things happening in the future or draw conclusions from what has happened in the past. There is more. Suppose one regroups the behavioral, emotional, and cognitive functional bubbles on the right side of the attachment bubble: one would end up with one big bubble called attitude-towards-the-mother (a *mega-bubble*) or more precisely, a mega-construct. There would be one functional arrow going from the *attachment*-towards-the-mother bubble to the *attitude*-towards-the-mother. But a minimum of *two* functional bubbles are needed. That's the rule; otherwise the arrow is not a constituent arrow, but a consequent arrow. This forces the researcher to think: *Well then, if one was to add at least one more functional bubble on the right of the attachment bubble, what could it be?* Is it possible that the attachment is functionally represented by more than just attitude? (See Fig. 4.5)

Attachment probably has something to do with attitude, so the researcher thinks; but he also thinks it has to do with lifestyle. So it is possible that the second functional bubble for attachment is the concept of lifestyle: the fact that the child leads a particular lifestyle is a representation of his attachment to his mother, which in turn emanates in part from his needs. This lifestyle justifies some of his needs, giving this model a retroactive arrow. This would precisely create the attachment effect, because attachment, after all, has to be proven over time. So the researcher has just

[2] Note how the text "attitude towards mom" has three ovals (bubbles) around it. This is an indication of two other levels of depth: attitude has been found to be linked to intention, dependence, and trust. Trust has been found to be linked to affinities, benevolence, abilities, and integrity.

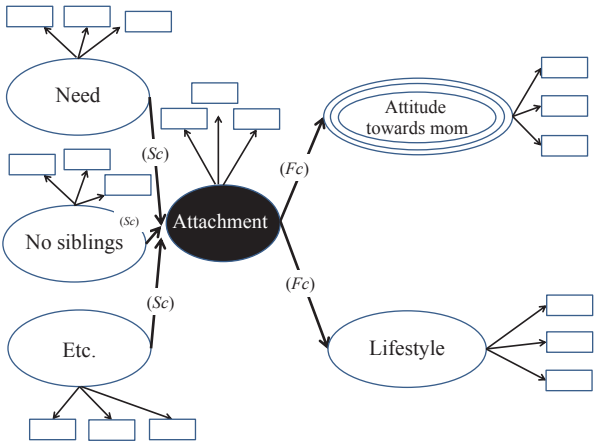

Fig. 4.5 Attachment

made the model very complex. He could go on: he could regroup the structural bubbles (needs, weak competition from siblings, etc.) on the left under one big bubble called inclination-to-attachment, and he would need to find another structural mega-bubble because structural bubbles cannot exist alone; they must come in pairs at least. He could also decide to expand his model by taking into account the time factor (he would investigate his model with the time factor, for example starting from the assumption that a particular need or desire causes an intention to be attached, which is incidentally different from having attachment.

As an example, the consolidated model of predation (CMP), in its initial modeling has started to look something like this (Fig. 4.6):

This model examines the bond between a highly anxious client and a psychotic investment consultant. In the above rendition of the model, it posits that trust and cooperation are at the heart of their interactional dynamic.

4.3 Conclusion

Whatever is developed clearly is easy to express—and research.

4.4 A Short Clinical Case

I have come across complex situations whereby a patient, for example, arrives for the therapy session in a state of disarray. Many problems seem to have all surfaced at once: a difficult spousal relationship, conflicts at work, lack of self-appraisal, shortages of energy, and abuse of own limits leading to extreme vulnerability, and so forth. Given the overwhelming challenge we both face, I must simplify the overall situation and establish more manageable scenarios. Eventually, I can take each scenario at a time (each simplified model) in order to

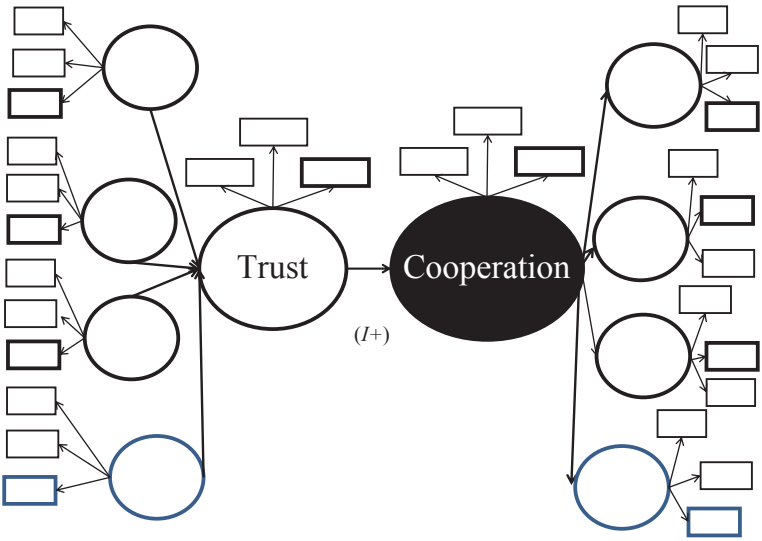

Fig. 4.6 The emerging model of perceived predation (template)

identify root causes as well as factors that have created complexity in the first place. (Claire Poulin, psychologist, 2014).

4.5 A Few Questions

A few questions	
Magic numbers	What are the magic numbers of data percolation methodology?
Template	"Have I established a template?" (work-in-process model, emerging model)

Constituent arrows come at least in pairs (minimum 2); observables come at least in triplets (minimum 3, maximum preferably 13); a model should not hold more than 4–5 constructs (failing which it needs to be reformatted into a simpler mode—as seen for the proposed attachment model—or subdivided into various parts)

4.6 A Few Keywords

A few keywords	
Template	Emerging model and the initial base for research

4.7 A Few Tips

The researcher should:

- Either regroup or break up: keep the template handy!
- Not favor complexity

Chapter 5
More on Data Percolation

5.1 Introduction

Already at a very young age, one learns to weigh options, develop scenarios in one's mind and create an image of reality that is pleasant. In order to do that, one asked questions such as "why?"

This chapter gives the researcher the tools to organize his questions.

5.2 Data Percolation—A Definition

A researcher's model is not worth much if he does not have the data to support it. Therefore, he needs to collect the data.

Annex B compares qualitative and quantitative methods[1]. Data can also come from three additional sources: (1) existing literature, (2) experts[2], (3) simulation (computer simulations, role-playing activities, or games such as the ultimatum game[3]).

To produce an excellent cup of coffee, one needs water that has been properly heated (the researcher's motivation), high-quality coffee beans that have been ground to the right size (data), and an espresso machine (proper methodology). The machine will extract the flavor from the coffee beans and produce a powerful, aroma-filled brown liquid with a layer of "crema" on top. The crema itself is an

[1] Bryman notes, most regretfully that "in only 18% of articles were the two sets of findings genuinely integrated" (Bryman in Bergman (Eds.) 2008, p. 98).

[2] Miles and Huberman (2003, p. 78) stipulate that an expert in this regard should (1) be familiar with the field under investigation; (2) display an interest in conceptualization; (3) show interest in multidisciplinary research efforts; and (4) be able to talk to people.

[3] Example: Maxwell et al. (2009).

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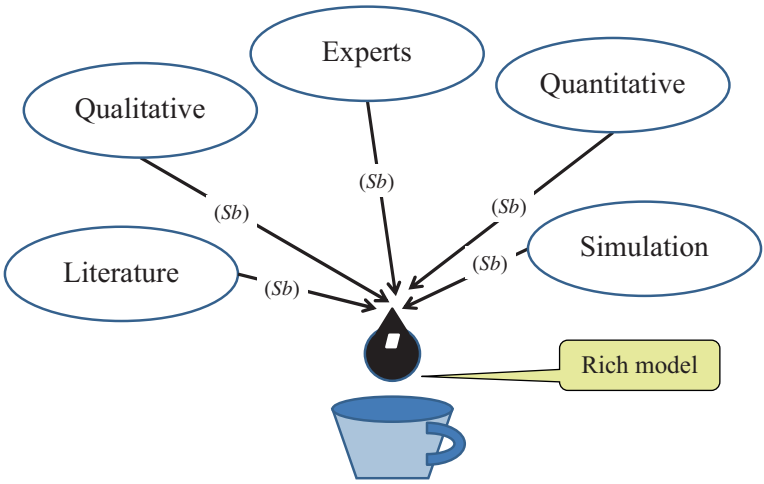

Fig. 5.1 Five sources of information

indication, prior to tasting the espresso, that the product will be tasty (it keeps the aroma and the heat).

Data percolation refers to the same kind of process: it is about collecting the data and grinding it to the ideal level, to finally obtain quality results.

The researcher does not have to become an expert in every type of data collection or in handling each of the five sources of data that he is using (qualitative data collection, simulation, etc.); he can focus on one of them as long as he still performs some of the others. He can also seek some help; maybe a professor, who is an expert at computer simulation, can assist him.

In short, the data percolation methodology is a mega-methodology that involves the collection of data from five sources (Fig. 5.1):

- Literature
- Experts
- Qualitative domains
- Quantitative domains
- Simulation (computer-generated, role-playing activities or games)

There is no particular order in which the researcher should access these five sources, although the above order (left to right) seems the most natural. But he may already be acquainted with the literature or with Monte Carlo simulation software and prefer to start working with what he is most comfortable with. In any case, as stated before, he has to navigate between these sources as his model emerges and becomes increasingly complex.

Of course, these five sources of information produce an avalanche of data. Heller (2007, p. 225) discusses the fact that such exercises can be seen as beneficial—if not to the researcher, then at least for science at large: “In addition to increasing

subject and methodological expertise, the increased ability to change perspectives is a favorable condition for scientific productions and technical inventions."

Suppose the researcher followed the standard hypothetico–deductive method: he built a model, created some questions, sent questionnaires to some random participants from among a targeted sample group, and ran analyses with the results. He notices an outlier on his regression graph that skews the regression line away from where he thinks it should be. What should he do? As it does not fit in with the rest of the data, he presses "delete" on the keyboard and it disappears from his database. He runs the regression again and it produces a near-perfect line.

However, it may well be that this outlier was a contrasting case that would require him to investigate further[4].

5.3 Data

Data that can be accessed in two ways: secondary and primary. Secondary data (those that help the researcher create the initial model—his working template) come from newspapers, books, articles, government statistics websites, spying, and so forth. They come in two formats: "contextual" and that "of constructs." *Contextual secondary data* deal with facts, sales data, sociodemographic information and the like. *Construct secondary data* come from research that has been published in scientific articles; they have often been tested in some specific context and at a certain point in time, and come with their own limitations.

Primary data are those that the researcher collects (they often help him look at his model right to left, that is, *backward*) and they help him make his conclusions. Nothing tells him whether the data he obtains from scientific articles are valid, have been properly analyzed, or have been analyzed the way he sees things. Therefore, it is worth for the researcher going out there and verifying the facts himself. The worst that can happen is that what he obtains corresponds exactly with what another researcher has found[5].

[4] Boutin is cited as follows (2008, p. 46): Sometimes, traditional methods (close-ended questions, standardized tests, etc.) fail to provide us with access to essential data: attitudes, perceptions, representations, etc. (author's translation).

[5] "15% of replication studies in the social science of marketing fully confirmed the prior findings and only 25% partially confirmed them" Sobh and Perry (2006, p. 1197).

5.4 Is Data Percolation Different from Triangulation?

In the 1900s, C.S. Pierce introduced the notion of pragmatism. Put simply, science had to have a useful purpose[6]. Up until the 1950s, research was purely qualitative or quantitative, rarely both. In the 1960s, researchers like Campbell and Fiske[7] (1959), then Webb et al. (1966) started to encourage the use of multimethods. In the 1970s, the trend moved in favor of hard methods, that is, quantitative analyses (it is also around that time when computers started to become popular). In 1978, Denzin came up with the word "triangulation," even though there were no triangles to be found in his theory. The idea was to combine methods with some sense of purpose. According to some authors, nowadays, roughly 14 % of the research uses mixed methods (68 of 484 studies)[8] and "in only 18 % of the articles were the two sets of findings genuinely integrated."[9] For example, if 5000 articles were printed every year in the top scientific journals, this would mean that 14 % of them, or about 700, used mixed methods. Therefore, if out of these 700 articles, about 18 % properly used triangulation, that would account for a total of roughly 120 articles per year or ten per month, 2.5 per week, that is, 0.5 per day. Knowing what is known now, namely, that a large portion of the models presented in these articles are erroneously developed, this leaves one with a very large opportunity for the researcher to mark his territory and become a top scientist.

Triangulation has been defined in various ways by a number of authors or could fall into a series of definitions. Triangulation can be viewed as:

1. "a part of research methodology [which goal] is the application of scientific procedures toward acquiring answers to a wide variety of research questions." (Adams and Schvaneveldt 1991, p. 16)
2. "a process that seeks to corroborate evidence acquired in different ways, and means for achieving triangulation stem from diversity of strategies, metrics, and methods."(S*ic*) (Dahlstrom et al. 2008, p. 139)
3. a "multimethod strategy…" (Brewer and Hunter 1989, p. 11)
4. "combining different methods within one intervention" (Munro and Mingers 2002, p. 378)
5. part of "different ways of engaging in research" (Buchanan and Bryman 2007, p. 485)
6. a multimethod, "Its fundamental strategy is to attack a research problem with an arsenal of methods that have non-overlapping weaknesses in addition to their complementary strengths." (Brewer and Hunter 1989, p. 17)
7. an integration of qualitative and quantitative methods (Hanson et al. 2005, p. 224)

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[6] Patton (1990, p. 12) writes: "The purpose of applied research and evaluation is to inform action, enhance decision making, and apply knowledge to solve human and societal problems."

[7] Multitrait-multimethod.

[8] Hurmerinta-Peltomäki and Nummela (2006, p. 439).

[9] Bryman in Bergman (Eds.) (2008, p. 98).

8. a "mixed method …one that combines qualitative data collection and/or analysis with quantitative data collection and/or analysis in a single study" (Hurmerinta-Peltomäki and Nummela 2006, p. 441)
9. "the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research" (sic) (Hanson et al. 2005, p. 224; see also Tashakkori and Teddlie (eds.) 2003, p. 212)
10. a simultaneous, consecutive, and iterative way of doing research (Brannen 1992)

Nowhere in these definitions is it clearly shown that triangulation involves the following: (1) auto-ethnography; (2) proper attitude; (3) searching for contrasting cases; (4) a general procedure for conducting research *prior* to collecting primary data; (5) modeling, including creating a model template; (6) collecting data through literature review, speaking with experts, and simulation; (7) looking for self-biases in the literature review; (8) identifying observables; and (9) establishing a control group (for example, in Marsh et al. 2013 *f*MRI's study, the sample is composed of 14 adolescents with psychopathic traits and "21 healthy individuals matched on age, gender, and intelligence"—p. 900).

5.5 Data Percolation and Errors

One of the objectives of data percolation is to minimize errors. Machines do not make errors, humans do. Some people will generally try to conceal their errors with tactics such as using overly complex models or operations and by accusing others.

One has to find ways to limit the number of possible errors, keeping in mind some are simply due to random occurrences (otherwise known as acts of God). The researcher's research world is prone to errors: he deals with the researchers themselves (personality, etc.), their thinking patterns, their methodologies, and measuring instruments, as well as the participants and the environments.

There are a lot of things that can go wrong in the way he conducts his research, especially if he uses data percolation: it is so intense and large in scope. He could end up creating a "soup of paradigms"[10] or a model template that is so difficult to read that he can no longer sleep at night. Miller and Mintzberg (1983) point to risks in doing research, such as the following: (1) specification errors; (2) assuming linearity; (3) assuming causality (very frequently found in scientific papers); (4) assuming temporality (yet the data was collected at only one point in time); (5) abstract variables; and finally (6) distance factors (e.g., using a questionnaire sent by mail: what guarantee does the researcher has that the person he assumed filled it out is actually the one who did?) Also, many times, variables come with covariance.

[10] Buchanan and Bryman (2007, p. 486).

There are other assumptions that researchers make, and that could well create biases in their collection and analysis of data[11]. Some researchers believe that verbal answers are a good reflection of behaviors—but are they (hence the importance of observation)? Some also believe that all participants understand the questionnaire the same way, but they may not.

Thus, a researcher's model and research strategies may be filled with erroneous assumptions, reduction or simplification errors, nonsense, or tautologies and spurious relationships. His data collection may also be faulty: selective or incorrect observation or even "made-up" information.

As Brewer and Hunter (1989, p. 84) point out, there is a risk to using multiple methodologies: "Another type of methodological effect stems from the possibility that one method will influence another method's application through the investigator rather than through the subjects."

5.6 Choose a Favorite Angle

For the researcher, the trick with data percolation is to focus on his favored way of investigating in consideration of his initial problem (the original purpose of his research), so he can solve it or conclude that it cannot be solved or does not need to be solved[12]. For example, Dahlstrom et al. (2008, p. 139) found that in 35.3 % of the research they looked at, ANOVA (Analysis Of Variance) was the preferred form of statistical analysis; so ANOVA seems to be a preferred method. They add (p. 148): "Regression is the most frequently employed technique in channels (30.5 %), product (46.5 %), sales (33.9 %), and strategy-based research (30.1 %)."

The researcher wants to pick methods (case studies[13], surveys, whatever) that offer some "complementarity," that is, where the data he collects through, say, interviews (qualitative) help him build his questionnaire for his next step: conducting a quantitative study. He also wants to pick methods that fit him best (each person is different and has strengths and weaknesses) in terms of knowledge, skills, personality, and talents.

Each step the researcher takes must be a building block to the next, so that he expands his possibilities, reinforce his definitions, polishes his bubbles and arrows, and better determines the participants he needs. In fact, if he uses the different sources of information appropriately and in a well-focused manner, he will likely discover some shortfalls in his way of thinking (for example, an expert could correct him on some assumptions) and identify some errors pertaining to another

[11] See, among others, Brinberg and McGrath (1985), Brewer and Hunter (1989), Babbie (1989), Brannen (1992), Neuman (1994), Maxwell and Loomis (2003), Sobh and Perry (2006).

[12] For more information on reasons for conducting multiple methodological research, see Brannen (1992), Munro and Mingers (2002), Hanson et al. (2005), or Hurmerinta-Peltomäki and Nummela (2006).

[13] See Yin 1997, 1999; Rispal 2002.

method (e.g., an exogenous variable that he did not think of but that reveals itself through some computer simulation). He may even find some rival explanations. Different causes may actually lead to the same outcome. Brewer and Hunter (1989, p. 42) make this valid argument: "complete control is impossible to attain even in true experimental designs. The suspected influence of uncontrolled third variables is therefore a prime source of rival hypotheses." Most often, some variables are discovered through the use of multiple informants and multiple methods[14]. The researcher looks for the black and white in definitions and in methods.

He has a duty to keep digging because, as Ackoff (1957, p. 7) pointed out, "in many inquiries the researcher does not know how accurate his results ought to be in order to be useful."

Bryman (in Bergman Eds. 2008) found that the main reasons supporting the use of mixed methods are the following: (1) research improvement (for 31.5 % of the respondents); (2) better sampling representativeness (13.4 %); (3) a more thorough analysis (13 %); and (4) a more diverse point of view (11.2 %).

There are obvious obstacles to conducting data percolation: it requires many skills from the same individual. It could turn out to be costly with respect to the value of the information to be collected. It may be difficult to compare data (preparation, material, identification of potential participants, etc.[15]).

The key criterion is to be able to compare data collected from various sources; otherwise the whole experience will be a massive weight (made up of articles, questionnaires, interview transcripts, etc.) on the researcher's shoulders. All in all, his research will become diluted and he will soon be part of the error himself: he will turn a blind eye to his errors. People often find excuses when it suits them to do so. Palys (1992) conducted a study in the USA wanting to know why people did not report crimes they witnessed. Excuses included the following: they did not know about it, did not want to admit it, did not think it was relevant, and assumed nothing could be done, could not be bothered, found it was time consuming, etc.

The last obstacle to the use of data percolation has to do with the publication of articles: "studies based on methodological approaches that cross boundaries face some difficulties in getting published" (Hurmerinta-Peltomäki and Nummela 2006, p. 440). This is what is called the "publication bias" (Bryman 1988, p. 168) and this is one reason why one cannot rely solely on scientific literature.

The key success factors in data percolation are therefore attitude[16], simplicity, focus, and being rigorous[17]. As for the data, it should be comparable, measurable and significant.

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[14] "A major source of uncertainty is that any study employing a single type of research method—and most studies still use only one method—leaves untested rival hypotheses (or alternative interpretations of data) that call the validity of the study's findings into question" (Brewer and Hunter 1989, p. 14).

[15] Miller and Salkind (2002).

[16] Which Morse (2003) in Tashakkori and Teddlie (2003, p. 190) would call integrity.

[17] See Tashakkori and Teddlie (2003).

5.7 What to Read?

It is unlikely that the researcher came up with his model based solely on his self-assessment. He probably needs to do some literature review. Yet, he should not restrict himself to scientific articles. They are not all bad; in fact, a few have been landmarks (*The market for lemons*—Akerlof 1970—being an example). However, they have their own way of seeing the world. So literature reviews should include formal and informal texts, popular books, newspaper articles, blogs, government data, etc. Here is an example of a newspaper article that helped in the creation of the Consolidated Model of Predation (CMP):

> Shoppers Drug Mart charging key suppliers: Preferred vendors billed equivalent of 20 % of business: Shoppers Drug Mart Corp. has taken the unprecedented step of charging key suppliers a fee for doing business with the retailer, a move that has some of the vendors crying foul. A surprise bill from Shoppers to all of its private label product suppliers went out last month, asking them to remit a "preferred vendor" charge equivalent to 20 % of their business with the retailer in November and December." They said 'either you pay it or you're out [as a supplier]'—there was no discussion," said an industry source who referred to the missive as a "shakedown." Another supplier who refused to pay the clawback had all of his products shipped back to him (sic)" (National Post; Tuesday, January 18, 2005; Page: FP1/ Front; Section: Financial Post; Byline: Hollie Shaw; Source: Financial Post). (*Sic*)

There is just no other way to make sure that the definitions the researcher allocates to his constructs and the terms he uses are comprehensible to his participants than by walking the walk.

For example, in the some 200 structured interviews done with participants with respect to the CMP, never did the word "predation" come up. The words "domination," "abuse," and others were used instead. Same for equilibrium; participants had another vocabulary that turned out to be very rich in meaning: win-win. A study in 1974 revealed the differences in quantitative evaluation of speed in car accidents based on minute changes in the choice of words when describing the event[18]. Words must be tested in the field prior to sending a questionnaire out to hundreds or thousands of potential respondents.

Using the data percolation model, the CMP evolved as per Fig. 5.2:

As can be seen, the model started more like a marketing model but eventually evolved into a psychological model.

Seeking the view points of at least two experts is also recommended[19].

The model as seen through the lenses of a literature review could well take on a different aspect as seen by a mathematical expert, as exemplified below (Fig. 5.3):

[18] Loftus and Palmer (1974).

[19] Van Bruggen et al. (2002, p. 470) present the following arguments: (1) one source could produce errors or systematic biases; (2) no one can be an expert on everything, including on all the elements of a model; (3) a larger number of experts helps to reduce errors due to chance.

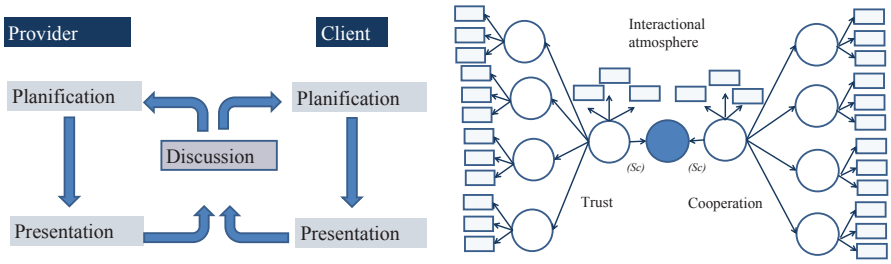

Fig. 5.2 The CMP through the lens of literature

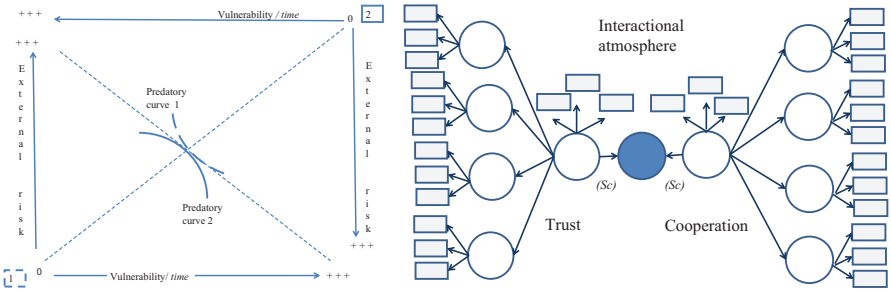

Fig. 5.3 The model through the lens of mathematics

The researcher's goal is to anchor his model into reality, to prove that it has value, hopefully in many areas of human activity, and that it has social relevance. So he has to break new ground, take risks, and seek the unusual.

5.8 Conclusion

Data percolation is a mega-methodology that starts with modeling and follows with accessing at least three sources of credible information.

5.9 A Short Clinical Case

"DSM-V is a tool I use regularly. I also seek other sources of information; I certainly rely on my own experience, but I also talk to colleagues (experts) whom I sometimes refer patients to. I also investigate contemporary literature in recent scientific articles. With some patients, I also explore hypothetical scenarios in order to find which one is the most realistic and promising. When facing challenging cases,

I do not feel my work is complete until I look at them from every angle possible in order to make sure I have not missed an important step that would be crucial to the patient's well-being." (Claire Poulin, psychologist 2014).

5.10 A Few Questions

1. List a few potential sources of error in research.

5.11 A Few Key Words

A few things to remember and key concepts	
Triangulation	A word used to say that qualitative and quantitative data are compared
Contextual secondary data	Data that already exists and that pertains to some known facts (population statistics, etc.)
Construct secondary data	Scientific writings that present tested models and constructs
Five sources of information	Literature Experts Qualitative domain Quantitative domain Simulation (computer-generated, role-playing or games)
Key researcher attributes	1. Attitude
	2. Simplicity
	3. Focus
	4. Being rigorous
Attributes of key data	1. Comparable
	2. Measurable
	3. Significant

5.12 A Few Tips

The researcher should:

- Be rigorous
- Challenge his own thinking

Chapter 6
Some Qualitative Techniques

6.1 Introduction

Qualitative methodology is an excellent choice when one wants to look at processes. One can't expect people to fill out a quantitative questionnaire to explain how, for example, they came to trust their spouse only to find out later on that they had been cheated upon for the last 5 years. There are many tools available to the researcher in qualitative research. This chapter does not pretend to reinvent the wheel; rather, it gives the researcher a few tips on how to collect data to support his template model.

6.2 Observe

Observing is listening with one's eyes and ears. Observation is "zooming in" while having no preconceived ideas occupying one's thoughts and living in the moment without consideration for the past or the future. The researcher does not need to respond or have opinions. Observation is critical to any research. The present author was doing a study at a Toyota dealership, in the service department. That department ranked consistently higher in terms of quality service than the other car dealerships he was investigating. He needed to find out why. He could have sent a questionnaire and asked the clients questions such as: (1) "How quickly did the service personnel respond to your needs?" (2) "Was there a coffee or water machine at your disposal?" (3) "Was the personnel courteous?" and (4) "What age group do you belong to?"

What gave the author the real answer was a detail. A detail he could not even have rendered as a question on a quantitative survey. It had to do with hands. As one can imagine, most people perceive service personnel at car dealerships as having dirty hands, even if it is not the case. The mere fact that they work closely with auto parts, or mechanics, or that they are sitting close to the maintenance area, is enough to create an image of dirtiness in the minds of most customers. The researcher observed

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that service personnel at that particular Toyota dealership invariably approached the customer sitting in the waiting room with their hands hanging nonmenacingly on either side of their body, in plain sight. Somehow, unconsciously, this gave customers the feeling that the hands were indeed clean (as they in fact were). Never did the personnel try to shake hands or touch the customer or the customer's belongings. This, it seemed, was part of the explanation for why people, most probably unconsciously, appreciated Toyota dealership's service.

There are millions of details like this that do make a difference in encounters where psychology, the conscious or the unconscious, plays a part. The researcher is trying to identify the observables that will allow him to accurately measure his constructs. Good data percolation and good espressos require a proper process.

6.3 Interviews

Robinson (2014, p. 25) suggests the following well-guided recommendations for choosing participants:

> Defining a sample universe, by way of specifying inclusion and exclusion criteria for potential participation; (2) deciding upon a sample size, through the conjoint consideration of epistemological and practical concerns; (3) selecting a sampling strategy, such as random sampling, convenience sampling, stratified sampling, cell sampling, quota sampling or a single-case selection strategy; and (4) sample sourcing, which includes matters of advertising, incentivising, avoidance of bias, and ethical concerns pertaining to informed consent.

A good interview should not last longer than 90 min and ideally be between 45 and 60 min (excluding the necessary introductory procedures). Face-to-face encounters allow the researcher to explore emerging themes, to generate viewpoints not yet captured in scientific literature, and to observe the emotional component of the participant's behavior and speech.

A technique that is seldom used, but that should be used more often, is what is called a *participative summary*. Every 20 mins, the researcher makes a summary of what the participant has said, preferably with simple phrases and diagrams. This shows the participant he is listening carefully (which the participant will appreciate). It allows him to correct errors in case he misunderstood what the participant said. It forces the participant to stick to the point in case the interviewee starts to wander off to different subjects (which happens very often). It facilitates his subsequent analyses of the verbatim speech if he records the interview. Finally, it offers a welcome pause in what can sometimes become intense, if not entirely emotional. About 80 % of what people say is useless according to Pareto's law; this leaves 20 % valuable information. Out of this 20 %, around 80 % of the meanings are actually nonverbal. This leaves a very tiny 4 % of the 60 min exchange as being of real value to the researcher, i.e., 2.4 mins or approximately 450 words, which amounts to approximately 20 short sentences.

Of course, the participant should be well chosen in the sense that she/he at least knows something about the subject the researcher is investigating. The researcher does not want to give the participant the feeling he is using her/him; he should always give her/him feedback a week or so after the interview. It is also recommended to do, if possible, a second interview (Guba and Lincoln referred in 1989 to the "dialectic hermeneutic circle"), and this is why: in the first interview, the respondent may have been somewhat shy or else apprehensive; she/he may have forgotten to discuss or bring up important aspects related to the researcher's constructs; finally, the researcher can use the participative summary he prepared for the entire first interview to help dig deeper into the topic of conversation.

The researcher wants to arrive at a point where he does not learn anything new by meeting an additional participant (this is called the *saturation* point).

6.4 Focus Group

An ideal number of participants in a focus group is nine—this odd number is favored in case one needs to hold a vote and wants to avoid a tie. There is a very effective way of running a focus group that, unfortunately, is seldom used.

It is called the *consensus circle*. Participants all sit in a circle. Everyone gets a chance to talk, moving clockwise or counter clockwise, it does not matter. When one participant is talking, the others are NOT permitted to talk. They must listen (this is often the toughest part for some participants). The one participant who talks should use one word or at most one sentence, no more (this is also a challenge for many). Once the first participant has expressed her/himself on the given topic (or the question asked by the researcher), the next one in the circle follows the same process, and so on.

As people are limited in the number of words they can use, they usually try to stick to the point, and they do not go on forever on topics that are not part of the agenda—which someone will inevitably notice. Once the run is over, the participants go at it again. This time, the researcher tells participants that they can change their opinion, stick to what they said, or adopt another participant's opinion. After the second run, the researcher will find some emerging trends; there will be two or three groups with diverging opinions. If he is lucky, they will all agree. Once the author of this book ran a focus group with ten participants working in the same office. The first thing they said as they sat down was that the researcher would never get them to all agree on a subject, because they always argued. A question was posed: "Do you think it is impossible to reach unanimity in this room?" At the end of the first run, all participants agreed on the same point: it was impossible to reach a unanimous opinion!

In general, the researcher should avoid going straight to his topic; he should present two diverging topics at the same time, or sequentially. Under these circumstances, people forget that they want to feel important, and they focus on making a choice; because of this, they try to find something more meaningful to say, and the researcher ends up with richer information. This is what he is after: rich, sense-making data.

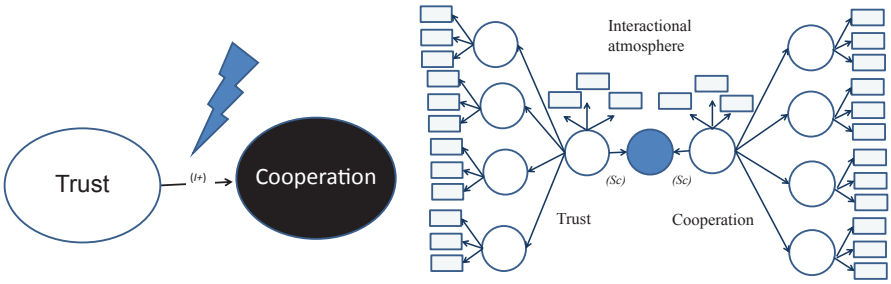

Fig. 6.1 Emerging model using data percolation

6.5 Conclusion

All in all, qualitative methodology is an excellent approach when researchers wish to describe events and processes, define constructs, clear up the concepts and ideas cluttering their brain, get an indication as to the kind of participants they will need for their quantitative quest, make sure their model template is in touch with reality, and check that they are on the right track by taking the pulse of real life.

Figure 6.1 shows how the Consolidated Model of Predation (CMP) model template (on the right) was somewhat corroborated by what was gathered in the field (on the left) using the qualitative techniques discussed above.

6.6 A Short Clinical Case

> In my practice, I must pay attention to words of course. That's the qualitative side of my work. I am also genuinely interested in identifying patterns and in putting emotions or sensations on a scale (for example; 1 is 'not intense', and 10 'very intense', or even 'unbearable' for feelings or emotions such as fatigue, pain, sadness, anxiety, etc.). I find that measuring with both words and numbers gives me a sense of objectivity. I invite the patient to visualize the pain, for example, on a scale and to give it a level (e.g. 5/10) –; connecting with emotions follows, and then a new quantitative measurement of the pain level is proposed. The patient feels in better control and I get a clearer picture of what the patient feels and how he progresses. (Claire Poulin, psychologist, 2014).

6.7 A Few Questions

1. The situation is getting a bit out of hand during a semidirected interview. What tricks can the researcher pull out of his hat to change the focus slightly and regain control of the situation?
2. What is the ideal size of a focus group?

6.8 A Few Keywords

A Few Definitions	
Saturation	The point at which meeting a new participant does not bring the researcher any substantial new knowledge
Participative summary	A technique by which the researcher reviews and validates his understanding of the participant's verbatim speech together with her or him, every 20 mins
Consensus circle	A technique by which a group discussion follows certain rules to minimize the risk of engaging in fruitless, often self-centered debates

6.9 A Few Tips

The researcher should:

- Follow the participant's speed
- Give participants at least 10 secs (super-minimum) to express themselves
- Understand trust is something that builds over time: a second visit is always better
- Have a contingency plan in case interviews or group discussions derail
- Not conduct more than two interviews in a single day.

Chapter 7
Simulation and Quantitative Techniques

7.1 Introduction

There are more bubbles and arrows to discover…

7.2 Numbers

Quantitative methods offer an undeniable advantage. While qualitative methods certainly help the researcher better define his constructs, establish temporary bonds between them (represented graphically with the appropriate arrows), and even help him decide on the precedence and consequence of actions (that is, they can assist him in establishing time flows of events, behaviors, and actions), they cannot give him the strength of those bonds, and at times they cannot even tell him what kind of bonds exists. Quantitative methods are there to help, in many different ways.

Linear thinking is the key to quantitative methods. Most assumptions concerning constructs are on the basis of linearity. Analyzing a nonlinear regression function proves to be very hard, and there are ways to turn some nonlinear regression functions into linear functions (which render the interpretation of the results and related constructs very difficult)[1]. It can be said that a majority of people think in a linear manner: since fish left oceans to turn into reptiles and mammals, their brains have been organized with a flat horizon in mind (underwater, one cannot really see a horizon). The researcher's emerging model should be built so that most, if not all, relationships between the different constructs are linear. When curvilinearly occurs, it is handy to separate different stages of the phenomenon into linear stages. For example, Baer and Oldham (2006, p. 968) find that there is a curvilinear relationship between openness and experience and support for creativity. First, both constructs

[1] Lambin 1990, p. 357.

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evolve together, thus displaying a relatively straight ascending curve; then a plateau is reached after which openness to experience diminishes as support for creativity increases, displaying a relatively linear descending curve. Hence, two linear curves can be assumed and an easy interpretation of the phenomenon can be rendered: perhaps, there is a saturation effect past a certain level (the plateau).

7.3 Sample Size

There are three basic criteria to be met in the researcher's choice of representative samples. They must be: (1) random (unless the researcher can scientifically justify proceeding differently); (2) representative (and thus significant); (3) sufficient in number. Generally speaking, 30 is a good number for exploratory regressions, and 100 for a descriptive analysis[2]; for Structural Equation Modeling (SEM), it is generally recommended that a minimum of 135-150 or even 200, depending on the software (e.g., Amos; PLS, which accepts smaller sample sizes in psychological research with some efficacy—see Willaby et al. 2014)

In the data percolation methodology, one reverts back to focus groups as follows: an ideal number of participants is an odd number, preferably a multiple of three and a number small enough to be manageable. Focus groups discuss things such as the researcher's constructs of interest. Constructs are measured by observables. So one could have a group of nine participants discussing each observable of a construct and then build up the model accordingly.

The same logic applies to statistical measurements: the researcher wants to have nine participants per observable. It is as if he dedicates one focus group per observable; knowing that there is a minimum of three observables per construct, the absolute minimum number of participants for a one construct model[3] is 27 (near 30):

- One bubble × 3 observables per bubble × 9 per observable = 27

For a model with five constructs (one central construct, a minimal number of two structural variables, and of two functional variables) the minimal number is 135. Each construct that has a link to more than one construct should also be measured independently; so if one has the trust construct having four structural constructs (or variables), 135 is the minimal number of participants for one's research (given no functional variables are attached to the construct). This way of calculating is easy and can be justified. The minimal number of participants for a single regression is approximately 30, but one cannot generalize the findings with so few participants. For a structural equation modeling, it is approximately 135–150. All this points to the fact that overly complex models will end up requiring a lot of participants.

For the number of participants required in a qualitative study, each unit of the "9" (participants in a focus group) is considered as a single visit to the same partici-

[2] Mongeau (2009, p. 94).

[3] For other ways to calculate required sample sizes, see Cohen, 1992. Our method is much simpler however.

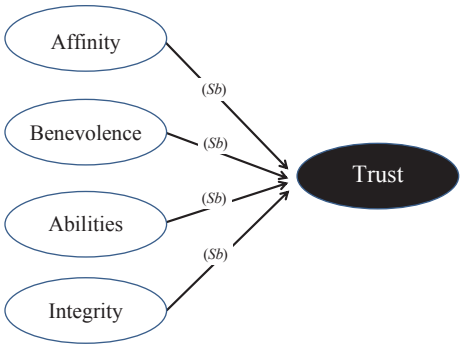

Fig. 7.1 Trust at the relational level between a patient and her/his therapist

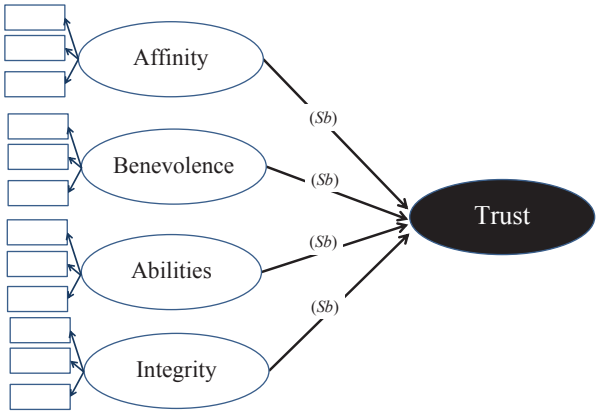

Fig. 7.2 Trust with observables

pants. Hence, a single case study would require nine (9) visits to the same participant, assuming each visit is used to collect meaningful information.

7.4 Questions?

Nunnally and Bernstein (1994) specify that questions must obey the five criteria mentioned earlier; they must be: (1) meaningful to the respondent; (2) pertinent; (3) measurable; (4) objective; (5) economic in their use of words.

To create a question, the researcher needs an observable. For example, "The patient smiles" can be turned into the question (= >) "Does the patient smile?" There have to be three observables per construct as a minimum, therefore, three questions[4]. This can be represented as follows (Fig. 7.1):

Leading to (Fig. 7.2):

[4] Anderson and Gerbing (1988, p. 414) mention: "[…] at least four measures of a construct are needed for an assessment". However, one can't decide the outcome of a boxing match with an even number of judges.

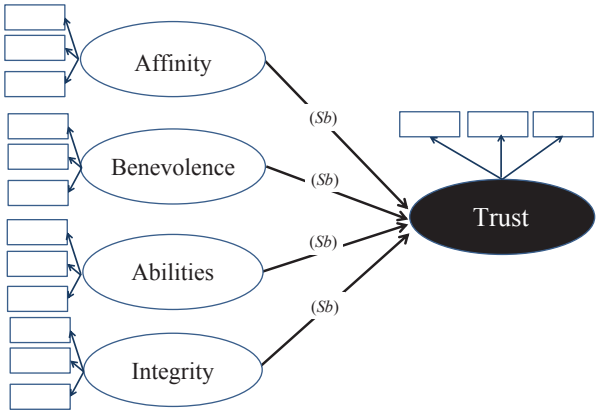

Fig. 7.3 Trust (extended bubble)

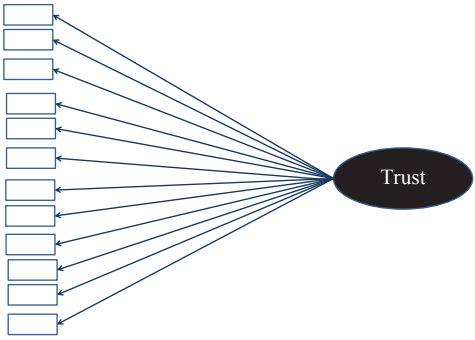

Fig. 7.4 Trust (isolated bubble)

The observables or questions may be derived from interviews, but the researcher must be careful. Sometimes participants, (because of a cultural bias or the lack of a construct in his culture) may misinterpret the construct.

Again, note that the structural arrows aim for the same point along the construct of trust, and the arrows pointing to the rectangles (the observables) depart from the same point along each subconstruct (affinity, benevolence, ability, and integrity).[5]

The bubble (construct) on the right (that of trust) is said to be *extended*, because it has bubbles (subconstructs) between itself and the ultimate observables. On top of that, it would need to be measured with its own three observables (Fig. 7.3):

The researcher could decide to avoid referring to the 4 subconstructs, yet use the 12 observables that have been generated; the bubble is then said to be *isolated* (Fig. 7.4):

So in that case, the researcher would end up with 12 questions leading him to the main bubble without referring to the subconstructs. This can be a useful way of

[5] Miles and Huberman (2003, p. 370) use a system that is somewhat similar.

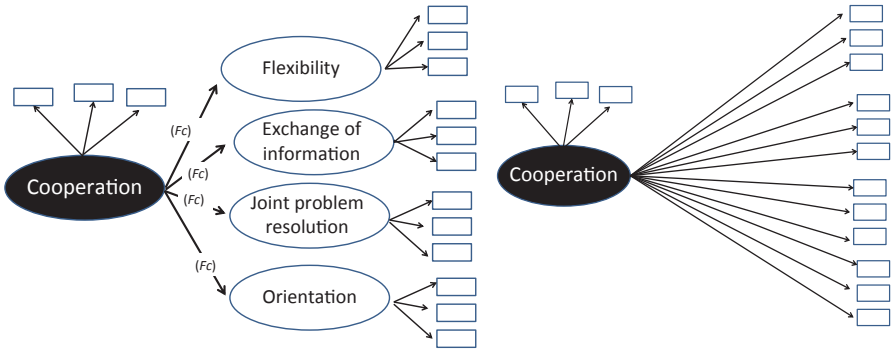

Fig. 7.5 Cooperation (extended bubble)

measuring a construct on an exploratory basis or when the number of participants is low. The computer will not know the difference between extended and isolated bubbles.

The researcher would obey the same kind of reasoning for bubbles with functional arrows, which could then be turned into an isolated bubble (Fig. 7.5):

As one can guess, sound psychometric qualities in a questionnaire start with proper modeling. Anything short of that will produce a dubious research. It also must be grounded in observation (behaviors that the researcher witnesses or that are self-reported in interviews for example).

There are standard pieces of advice about how to formulate questions in any good quantitative book (such as: avoid leading questions, two questions in one, etc.). Questions have to be meticulously drafted and pretested as much as possible. The researcher has to be careful of what he wants to measure. In the Anxiety Symptom Questionnaire (see Schutte and Malouff 1995, p. 152–153), question 26 reads: "I prefer to avoid making specific plans for self-improvements." In this question alone, there are three constructs: preference, specific plans, and self-improvement. A question must test one observable of one construct at a time. Question 32 reads: "I have to be careful not to let my real feelings show." This question infers a sense of duty or an obligation ("I have to"), and begs us to want to know what "real feelings" mean. But one can probably bet that the sense of duty or obligation is not what the questionnaire was all about. In the Mississippi Scale for Combat-Related Post-traumatic Stress Disorder (see Schutte and Malouff 1995, p. 239), question 26 reads: "No one understands how I feel, not even my family." There are two questions in one: one question about "no one" and one question about "my family". As for the Sexual Arousability Index (see Schutte and Malouff 1995, p. 293), there is a double scale, with −1 related to a particular construct (disgust) and another scale 0–5 measuring another construct (sexual arousal). One must avoid double scales.

The reader will want to refer to works related to proper psychometric properties. For the purpose of the present book, it is sufficient to remind the researcher that a good observable and a good question are meaningful and measurable, and consist of the simplest sentence possible (subject, verb, and complement).

Also, the researcher must avoid, by any means, additive questionnaires—which are unfortunately a rampant problem in scientific literature. Additive questionnaires occur when the same question is repeated a few times in a slightly different form[6]. This is a huge mistake. From a modeling point of view, it is diluting the measure of the construct with the same information; furthermore, this system measures more whether the respondent sticks with her/his answers than the actual construct. But the researcher is not trying to measure whether the respondent is consistent[7]!

The reason some scholars like additive questionnaires is that they wish to meet Cronbach's alpha best levels. However, this measure is sensitive to the number of questions asked[8]; it thus contains an inherent bias. Cronbach's alpha is a trap into which the researcher working with data percolation should not fall. It must be used as a secondary tool to see if something can be improved in the questions having been generated through proper modeling. One can reach high Cronbach's alpha *without* using additive questions (Mesly 2010; see Annex D). Cronbach's alpha is a means, not an end.

7.5 Scale

A seven-point Likert scale is favored. A ten-point Likert scale runs the risk of bias in the sense that people used to the uneven separation of the scale (for example, in some schools, the passing grade is 60% and not 50%) may confound the actual values they are trying to express. Additionally, there is no middle point with a ten-point scale. With a seven-point scale, 4 is the middle point: it divides three levels of intensity below it (levels 1, 2, 3), and three above it (levels 5, 6, 7). Observables-turned-into-questions are something that moves; they have movement, and they can be measured in intensity. This is the purpose of the Likert scale: measuring the intensity of the movement (e.g. from 1 = "not at all" to 7 = "completely"; or 1 = "do not agree at all" to 7 = "completely agree"). The number 4 serves as the neutral point. Note that the intensity goes from negative (not at all) to positive (completely) because most people are used to left-to-right measurements.

Many researchers commit another grave error. They use different measurements within the same scale. As an example, some scales go from 1 = "completely agree" to 7 = "completely disagree". By using two different words (agree and disagree), one risks measuring two different things, at least in the mind of the respondent. This is to no avail: some studies have shown, for example, that satisfaction and dissatisfaction do not entail the same emotional content[9].

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[6] Here is an example: "(1) Shopping at (grocery retailer name) makes me feel good; (2) Shopping at (grocery retailer) makes me very happy; (3) I love shopping at (grocery retailer name); (4) I am passionate about shopping at (grocery retailer name); (5) Shopping at (grocery retailer name) is a pure delight." See Vlachos, Theotokis et al. (2010, p. 1497).

[7] See LaTour and Miniard (1983) for a discussion on errors that can be generated by repeated measures.

[8] Cronbach's $\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K} \sigma_{Y_i}^2}{\sigma_X^2}\right)$ where K is the number of questions! The more one repeats one's questions, the better!

[9] Oliver 1980.

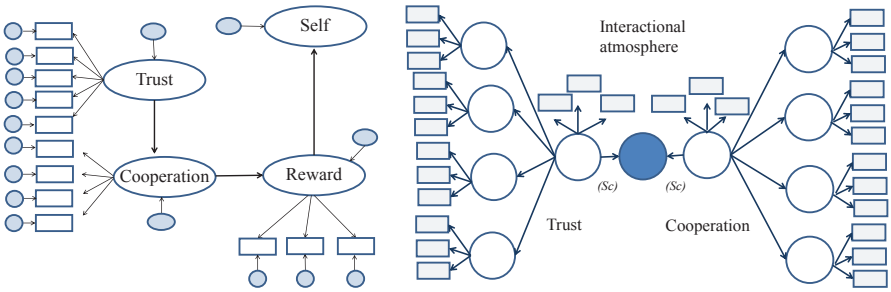

Fig. 7.6 The model through quantitative lenses

It is best to avoid giving the respondent an opportunity to answer "I do not know"; first, the number 4 is there to represent this option (it is neutral) and second, the researcher wants to submit questions to respondents that they can answer; otherwise, what's the point?[10]

Another point: many scales are erroneously "manufactured" in the following manner (example): "You are (a) between 20 and 30 years old; (b) between 30 and 40 years old". Here the problem is that the respondents who are 30 are not sure if they should answer (a) or (b). Another example: "You have worked for this company (a) less than 5 years; (b) between 5 and 10 years"; the respondents may not be sure what they should answer if they have worked at the company for 5 years. A final example (which is often seen): "You have (a) 1 or 2 children; (b) 2 or more children"; here, obviously options (a) and (b) offer the same possibility of response (2 kids).

The researcher always reviews his scale from A to Z before measuring.

The consolidated model of predation (CMP) through quantitative lenses started to look something like this (Fig. 7.6):

7.6 Conclusion

As the researcher applies data percolation, starting with proper modeling and then following up with choosing at least three methodologies to collect and analyze data, his model will gain in precision. As an example, the CMP emerged as follows (Fig. 7.7) in the case of Amway, an American multilevel marketing company, which capitalizes on the psychological phenomenon of fantasy just as Las Vegas does:

The next chapter discusses yet more types of arrows and bubbles as well as how to build a proper hypothetico-deductive procedure using the data percolation methodology.

[10] Semantic scales such as Osgood's (good, bad, large, small, etc.) should be avoided. A scale uses a common measure across different questions; otherwise, comparison is nearly impossible.

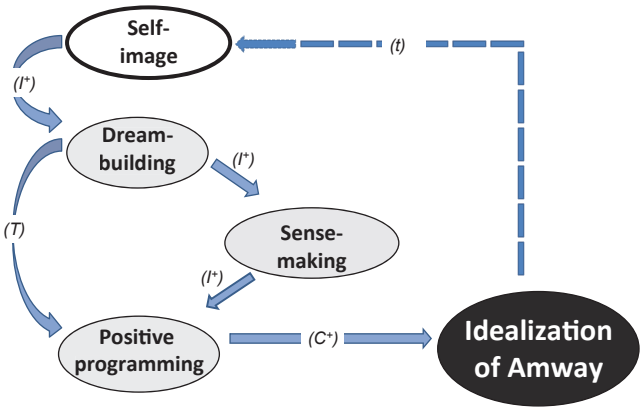

Fig. 7.7 The consolidated model near its ever-evolving format applied to the case of Amway

7.7 A Short Clinical Case

"I remember a patient who had lost of fair bit in her recent life, including a loving relationship. She came to believe that playing at the local casino and winning would make up for her losses. From a sense of worthlessness (caused in part by the fact that her husband had cheated on her), she moved into a state of artificial well-being, believing the odds were playing in her favor. The machines served her dream of living a happy life, all the while hiding from friends and close ones the fact that she was digging a considerable financial hole. Yet, she kept making herself believe (self-programming) that her life would turn around for the best, which in the end only caused her emotional turmoil." (Claire Poulin, psychologist, 2014).

7.8 A Few Questions

Question or advice	Yes or No?	Correct answer
Cronbach's alpha can be a trap		(yes)
The researcher should favor additive questions		(no)
In simulation, linear thinking is key		(yes)
Likert scales from 1 to 7 are ideal		(yes)
Questions must be as complex as possible		(no)
One should use two different reference measures on the same scale		(no)
There are constructs and mega-constructs		(yes)
Cronbach's alpha is sensitive to the number of similar questions asked		(yes)

7.9 A Few Keywords

Psychometric I	Meaningful to the respondent
	Pertinent
	Measurable
	Objective and
	Economic in the use of words
Psychometric II	No leading questions
	Subject, verb, complement
	No double-questions
	No questions out of context
Number of participants	Nine (9) per observable with each observable being representative of the construct, and each construct being properly defined. Three (3) observables per construct
	Number of bubbles × 3 observables per bubble x 9 per observable = Number of participants required for a quantitative study
	Divide 9 by the number of "research" visits to the same participants for a qualitative study as each visit is a proxy for a new participant
Extended bubble	A construct that is measured by way of sub-constructs that are measured by observables or else sub-sub constructs
Isolated bubble	A construct that is measured by the observables pertaining to its sub-constructs, without identification of these sub-constructs

7.10 A Few Tips

The researcher should endeavor to:

- Talk to people
- Accept that his model evolves as he goes on with his research
- Work with "what if" scenarios
- Not use additive questions
- Not use Cronbach's alpha as an absolute goal for creating his questions
- Not use complex questions

Chapter 8
The Hypothetico-Deductive Method

8.1 Introduction

This is where the researcher stands right now (Fig. 8.1):

Once the researcher walks down the hypothetico-deductive path, constructs and bubbles are called variables.

It is now time for him to formulate some hypotheses regarding his model. He should always keep in mind, however, that in real life he sometimes proceeds by making assumptions and formulate hypotheses, but he also relies on gut feelings and induction. So a step in the hypothetico-deductive world is NOT the end of the world or of his research: it is part of his journey to becoming an expert in data percolation.

8.2 Types of Research

The researcher should not work on hypotheses before he is reasonably satisfied with his model. Once this has happened, he wants to confirm what kind of research he wants to do. He may have originally planned to restrict himself to descriptive research (finding a definition for his constructs—for example, a definition for a construct such as perceived predation using (*S*) and (*F*) bubbles), but he may also want to find out more.

There are essentially four types of research. Unfortunately, some researchers tend to confuse them and claim, for example, that they did causal research when in fact all they did was pure speculation.

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O. Mesly, *Creating Models in Psychological Research,*
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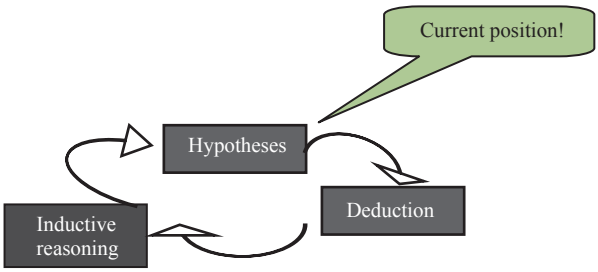


Fig. 8.1 A road map to evolution—Part II

Here are the four types—choose one:

- Descriptive (which can be comparative)—one uses (*S*) and (*F*) arrows
- Relational (measuring the influence of one variable on one or others)—one uses the (*I*) arrow or else chained arrows (*H*)
- Predictive (longitudinal)—one uses the (*T*) arrow
- Causal—one uses the (*C*) arrow

It is true that during a hypothetico-deductive investigation, the researcher should try to be as objective and as unemotionally "connected" to the respondents as possible. In an ideal world, one could test the variables in highly controlled or fully controlled circumstances. The researcher would have two clone groups, one where one variable would be tested, and the other where it would not, and all the other variables would be held constant, just as is attempted in research labs around the world. This is often impossible to do in the area of social sciences and psychology, in particular, which is one of the reasons the researcher wants to learn as much as possible about the different significant variables using literature review, expert opinion, qualitative studies, and possibly simulation prior to conducting hypothetico-deductive research. It is also one of the reasons he looks for contrasting cases. In reality, there are few controlled variables in psychology, hence the requirement to resort to data percolation.

An example of a descriptive study is that of Levenson (2004) where two types of criminals were compared on a series of preset parameters: those initially selected for release and those actually released in the end. Parameters included previous treatment failure use of weapon or infliction of injury, documented or admitted history of variety of sex offenses, history of murder, or attempted murder, and so forth. This descriptive research allows the researcher to argue that "The results provide preliminary but encouraging data suggesting that the highest risk sex offenders are being appropriately selected for commitment" (p. 646).

In the four different research types discussed above, the "I" arrow points to the fact that one variable influences another. The antecedent variable is an explanatory variable and the consequent variable is an explained variable. An example of influence is the role of gestural misinformation in skewing eyewitnesses' testimonials of crime scenes. It has been found that eyewitnesses are not only influenced by verbal cues but also by nonverbal cues (Gurney et al. 2013).

The influence can be direct or indirect (moderating or mediating variables) positive ($I+$), negative ($I-$) or else positive–negative ($I\pm$ for moderating variables

only). The influence involves time, but time can be very limited; for all intents and purposes, it is possible to have bubbles that are vertically positioned in a model with "I" arrows in between them: one recognizes that the influence of one variable on the other is nearly simultaneous. More on this will be seen below.

The "T" symbol indicates that there is a clear time factor between the bubble on the left and the bubble on the right (the flow is always left to right with "T"); however, it does not mean that the left bubble (independent variable) is the cause of the one on the right (dependent variable). As mentioned before, some authors make the mistake of confounding influence and cause-and-effect relationships. This kind of "T" study is also called longitudinal or predictive, because often it can help the researcher predict what will happen if the current trend persists while other variables are held constant. An example where longitudinal study is required is in the case of the assumption that early childhood attachment distress leads to an adult's tendency to depression; only by looking at a large number of people from the time they are children (and suffer attachment distress) to the time that they are adults (and suffer from a tendency to depression or from depression) can a valid answer be provided (Morley and Moran 2011). A study by Sutin et al. (2011) with $N=4790$; age range 14–94 is not a longitudinal study per se, because it is not the same group of respondents that were analyzed throughout their lifespan from 14 to 94 years of age. Rather, 4790 people ranging in age from 14 to 94 years are assumed to be equal so that the 94-year-old respondent is assumed to be a good representation of what the 14-year-old respondent would be at 94. Based on this assumption, the authors are able to posit that personality traits ("prospectively") predict verbal fluency.

To conduct a longitudinal study, the researcher must measure a phenomenon at one point in time, hold his breath in the hope that no exogenous variables (so-called "externalities") come and affect the participants, and measure the phenomenon once more later. He can trick the time factor by measuring two similar groups of participants that do not influence each other, but for which group 1 goes through the phenomenon as it would exist at the point of time 1 and group 2 goes through the same phenomenon as it would exist at the point of time 2. This is nearly impossible to do.

The causal "C" arrow is the most difficult one to study. It is represented as follows (Fig. 8.2):

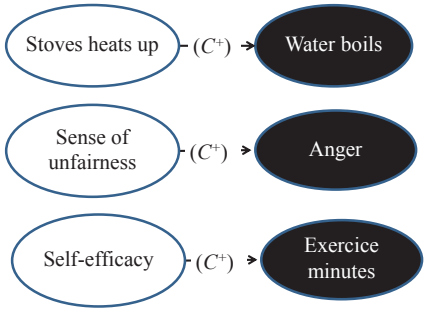


Fig. 8.2 The causal arrow

Table 8.1 The research's level of difficulty

	Type of research	Level of difficulty
Structural (*S*) and functional (*F*)	Descriptive	Easy
Influence (*I*)—positive or negative	Relational	Challenging
Longitudinal (*T*)	Predictive	Difficult
Causal (*C*)—positive or negative	Causal	In psychology, nearly impossible

There is no choice for the bubble on the right: it will necessarily occur given the bubble on the left (unlike a longitudinal study), 100 % of the time. Given a specific level of atmospheric pressure, water that is heated starts evaporating. Heat causes the water to evaporate: it will always evaporate given the appropriate heating level. The effect can be positive or negative; for example, some researchers state that smoking causes lung cancer, which is a negative outcome (yet others fight this conclusion vehemently). It is an error to have double-headed arrows (or chained arrows) with causal relationships.

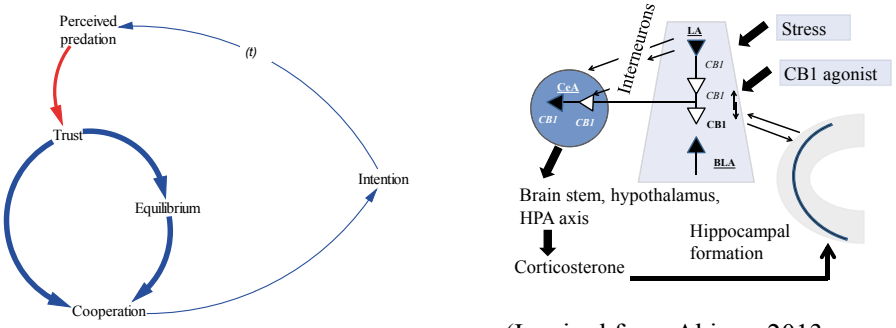
One way of convincing oneself that anger is caused by a sense of unfairness is to look at other kinds of populations, where this always occurs. For example, Seymour et al. (2007 p. 306) observe that "… chimpanzees attack allies that do not support them in third party conflicts, and queen naked mole rats will attack workers that they judge to be lazy". This may not be a proof but a strong indication of the assumption that chimpanzees realize that there is unfairness and that they react upon this realization. In their study, Basen-Engquist et al. (2013, p. 1137) resort to the concept of causal relationships as follows: "The consistency of the relationship between self-efficacy and exercise minutes over short (same day) and longer (Tj–Tj-1) time periods provides support for a causal relationship." Thus, causal links have found a place in psychological studies. Golden et al. (1987, p. 5) note: "Similarly, the cognitive-behavioral hypnotherapist assumes a direct causal link between cognitions or self-suggestions and emotional and behavioral consequences." Hence, here a causal link is assumed to take place.

The difficulty in doing research can be classified as follows (Table 8.1):

It is possible to add *retroactive arrows* (*t*) to one's model (loops) as follows (Fig. 8.3):

In Fig. 8.3, perceived predation diminishes the ability of the individual to trust others. A sense of unfairness (equilibrium) jointly with a lack of trust leads to lower social integration (cooperation) which may cause an intention to become violent, which then has a retroactive loop to the perceived predation construct.

Akirav's model (2013, p. 2560) is provided as an example. This is a typical model with retroaction because the pituitary gland does not feed back to the hypothalamus: hormones emanating from the hypothalamus or the pituitary gland must go through the blood stream before going back to the hypothalamus. In this example, stress affects the lateral amygdala (LA) and the basolateral amygdala (BLA), which then sends information to the central amygdala (CeA) and then the hypothalamus (HPA axis). The corticosterone travels through the blood stream to go back to the brain—the hippocampus and the amygdala. Borrowing from the constructs on the left of



(Inspired from Akirav, 2013, p. 2560)

Fig. 8.3 Retroaction (example) (This figure was obtained using Vensim as opposed to PowerPoint. Hence, different software will produce different ways of expressing the same model.) (Inspired from Akirav 2013, p. 2560)

Fig. 8.3 (which is a generalization of this process), this can be roughly expressed as perceived predation (stress) affecting trust (fear/amygdala), then affecting equilibrium (cognitive functions—in this case, memory/the hippocampal formation), with a retroactive loop eventually going back to trust (fear/amygdala).

The researcher will use the small "t". The retroactive arrows cannot go to a structural or functional bubble: these are timeless. They only emanate from and go to consequent and antecedent bubbles (variables).

8.3 Mediator and Moderator

Mediators ($I+$ or $I-$) and moderators ($I\pm$) are two forms of influence (I) arrows. Unlike the normal "I" arrow, they have an indirect influence on the variables they are in contact with. As put forth by Tofighi et al. (2013, p. 290) "Mediation analysis is a statistical approach used to understand how an independent variable produces an indirect effect on an outcome through an intervening variable (mediator)."

Figure 8.4 The mediating variable one can get to the right-hand bubble (B) by taking a direct road from the left-hand bubble (A). Alternatively, one could pass by the top bubble (Z) when one departs the bubble on the left (A) in order to get to the bubble on the right (B). An example of such dynamic is part of Moskowitz et al. model (2013, p. 1022) whereby recent stress acts as a mediating variable (Z) between emotional stress and suicide attempts. According to this model, emotional stress may lead directly to suicide attempts, but the presence of recent stressful events provides an alternative route that seems to encourage suicidal attempts. Chorpita and Barlow (1998, p. 9) propose that vulnerability acts as a mediating variable in their model on anxiety.

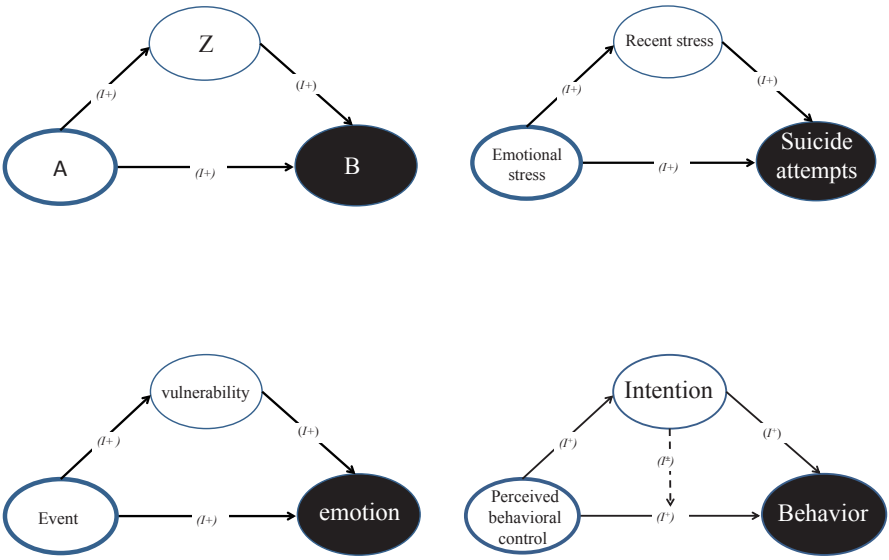


Fig. 8.4 Displays the mediating variable

As put in the example at the bottom right of Fig. 8.4, intention seems to be both a moderating and a mediating variable. Intentions are described by the authors as follows: "motivational factors that influence a behavior" and stronger intentions are associated with greater likelihood of performance or avoidance of a specific behavior in accordance with intentions (Ajzen 1991, p. 181). Thus, "individual's intentions to perform or abstain from a behavior are theorized to directly predict later behavior." (Rhodes and Clinkinbeard 2013, p. 26). However, a variable cannot act as both a moderator (a factor) and a mediator towards the same constructs, although a variable could act as a moderator for a set of constructs and as a mediator for a different set of constructs. In this case, clearly, intention is a variable of influence but not a factor in the sense of a moderating variable.

Baron and Kenny (1986) have developed an excellent technique for determining whether a variable is mediating or not. It is widely used. No qualitative study could really help the researcher decide if a variable is a mediating one, only a quantitative study can.

In the author's emerging consolidated model of predation (CMP), a vast array of participants and groups of participants were tested. It became clear that the construct "equilibrium" (win–win) was a mediating variable between trust and cooperation. This is how to interpret a mediating variable (example): a certain amount of trust could help develop cooperative efforts at the beginning of a relationship between a patient and his psychotherapist. However, if by some good fortune, each one senses that the encounter is a win–win situation, this may help or speed up the transition from the feeling of trust to cooperation. Equilibrium (win–win) is a mediating variable. One can live without it, but if it is there, that is good. One can go from point A

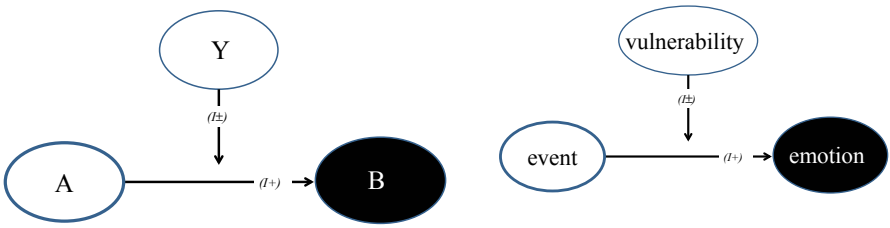


Fig. 8.5 A moderator

to point B without filling up one's gas tank, or one can go through point Z and get the opportunity to fill up one's gas tank at Z's gas station. In either scenario, one will end up at point B, but by going through point Z, one arrives at point B with a tank full of gas, which takes away the stress of having to find a gas station near point B. Point Z is a mediating variable.

There is also the moderating influence ($I\pm$). Figure 8.5 tells us a little bit about it:

It may be that the psychotherapist's personality (A) has a strong influence on the patient's intention to remain in therapy (B), but then, because the office where the therapy sessions take place is filthy, noisy, or has poor air conditioning (Y), it changes the patient's mood, despite the therapist's best efforts. The patient even decides to step out where there is fresh air. Generally speaking, a moderating variable is a factor that is external to the situation or the dynamics between the individuals. The best way to establish the existence of a moderator is to see how, for example, the participants behave with and without it (e.g., when the therapist re-establishes the flow of air conditioning (or cleans up his office), are the patients more eager to attend their therapy session?). In the example on the right, Chorpita and Barlow (1998, p. 9) propose an alternative to their initial model, with vulnerability acting as a moderator instead of a mediator. Moderation is statistically proven by a triangular distribution.[1]

Moderators are generally factors. In the field of criminal psychology, for example, the following external factors are thought to influence some individuals in becoming delinquent (while some others will seek to not fall into violence and compensate by excelling in society): culture (Fabrega 2004) and peer association (Katz and Marquette 1996). Applebaum et al. (1998), as another example, posit that conflict between individuals are shaped by both internal and external environmental factors.

One can also use statistical packages such as Partial Least Squares (regressions) (PLS). This is not always possible, of course, so to determine that the variable is an external factor is a good clue that it is a moderator. Moderating variables can be detected because they always lead to two opposite groups of reactions: in the case of the therapist's office, some patients will hurry to leave it because they want to escape the heat in it, while others will feel comfortable and secure, and even delay their leaving the office when the session is over. Hence, statistically, a moderating

[1] See Mesly and Lévy Mangin 2013; Mesly and Maziade 2013.

Table 8.2 All the arrows

Type of bond	Type of arrows
Structural (*S*) and functional (*F*)	Descriptive
	Binary (*Sb, Fb*)
	Continuous (*Sc, Fc*)
Influence (*I*)—positive or negative	Relational
Direct (*I* + or *I* −), chained (*H*)	
Indirect … mediator (*I* + or *I* −)	
Indirect … moderator (*I* ±)	
Longitudinal (*T*)	Predictive (*T*) or *(t)*
Causal (*C*)—positive or negative	(*C* + or *C* −)

variable has a triangular distribution (hence the use of the *I* ± sign). Many scientific papers do not recognize moderating variables and arrive at contradictory results; if the authors realized their results were contradictory because the variable was a moderating one, the debate would be closed. Note that in neuroscience, the concepts of moderating and mediating brain areas are used, but in a somewhat different sense.

Chained variables are two variables that influence each other concurrently, like two knights on critical squares of a chess board. This is found, for example, in the case of obesity and comorbid symptoms. Obesity leads to comorbid symptoms and comorbid symptoms lead to obesity. Similarly, it is generally recognized that PTSD is accompanied by comorbid manifestations, such as depression, drug abuse, social phobia, and so forth.

Let us summarize all the different types of arrows one finds under the data percolation methodology with Table 8.2.

That is all the researcher needs to create his model, yet many scientific models are, sadly, erroneous in their structure and explanatory power.

8.4 Hypotheses

In order to arrive at the tentative determination of *S*/*F* bonds, or *I, T*, or *C* arrows, the researcher must have been diligent in his modeling effort. Under the data percolation methodology, he must identify the type of hypothesis he is generating: $H^{(S)}$, $H^{(F)}$, $H^{(I)}$, $H^{(T)}$, $H^{(t)}$, or $H^{(C)}$. Also, a hypothesis can be tested according to two alternatives: H_0 (the so-called "null hypothesis") and H_a (its contrary). If the researcher has more than one hypothesis, each one should nevertheless be examined in consideration of the two options (each entailing some errors—type I and type II errors—consult with books on the subject). He must anchor his hypotheses in one of the four arrow modes (*S*/*F, I, T*, or *C*).

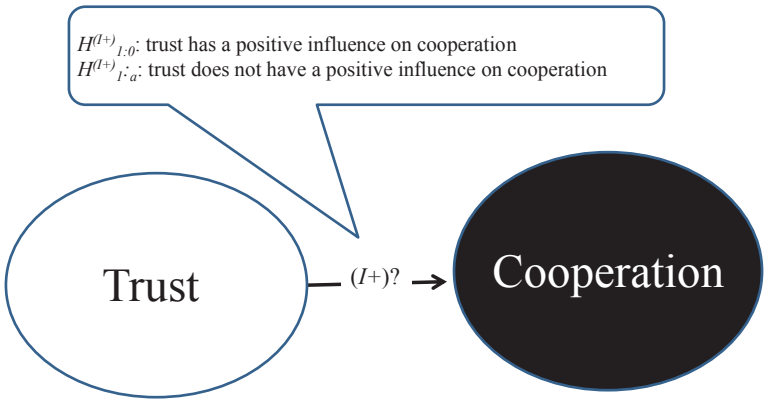


Fig. 8.6 Initial hypothesis. $H^{(I+)}{}_{1:0}$: trust has a positive influence on cooperation. $H^{(I+)}{}_{1:a}$: trust does not have a positive influence on cooperation

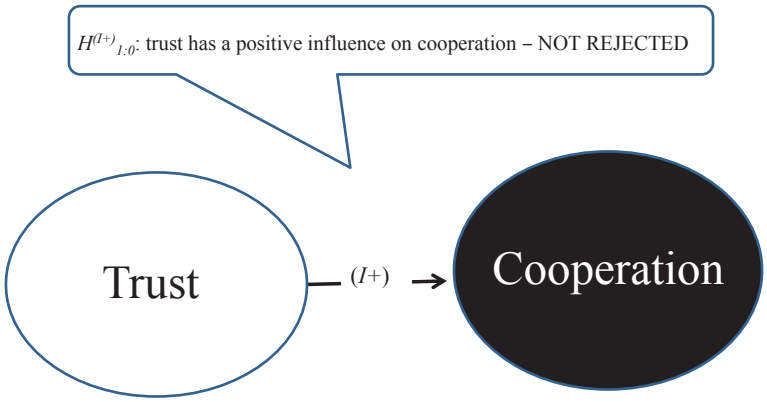


Fig. 8.7 Initial hypothesis with results. $H^{(I+)}{}_{1:0}$: trust has a positive influence on cooperation. $H^{(I+)}{}_{1:a}$: trust does not have a positive influence on cooperation

Let us consider a few examples. $H^{(I+)}{}_{0}$: trust does have a positive influence on cooperation; $H^{(I)}{}_{0}$: equilibrium is a mediating variable between trust and cooperation. A standard punch line must be used when the researcher evaluates his hypothesis in the end, after he clearly states his two options:

- $H_{1:0}$: residuals do follow a normal law.[2]
- $H_{1:1}$: residuals do not follow a normal law.

Using an image can help (see Fig. 8.6).

And then, once the researcher has the answer (Fig. 8.7).

[2] Some scholars reverse the order as follows: $H_{1:0}$: residuals do not follow a normal law. However, the rule is that the null hypothesis is an equality. It will take the form of =, ≤, or ≥.

Note that technically, a hypothesis is never actually confirmed. The best one can do is assume it is likely valid. Once the researcher assesses his model like this, testing all possible links between constructs, he can then clean up the final model by keeping only the links that are of value from the point of view of data percolation (from all five angles of analysis). What is neat about quantitative analysis is, as mentioned earlier, that it can help reinforce the model by better explaining the nature and the strength of the links between the variables.

8.5 The Questionnaire

The researcher prepares the quantitative questionnaire by taking into consideration the statistical measures that he wants to take with respect to the model.

Even though a 7-point Likert scale is recommended, they do not apply to ALL questions. For example, socio-demographic questions are not answered with such scales. It is most important that the researcher determines what exactly he is trying to test with his hypotheses (the type of research and subsequently, the links or connections that exist between the variables) and then that he determines what type of data he is going to seek. As many researchers know from reading numerous books on statistics, data come in different forms: nominal, ordinal, ratio, or continuous. What the researcher wants to keep in mind is that he must identify the kind of data he has, most particularly because not all statistical techniques apply to all types of data. Typically, for example, a regression applies to continuous data (with occasionally some binary 0–1 variables). The researcher should also determine if his data are paired or independent. This too will determine what statistical analyses he can perform.

According to the data percolation methodology, the researcher must ask himself four basic questions before finalizing his questionnaire, collecting his data, and analyzing it:

1. "What exactly I am trying to measure?
   a. Is there a link between two constructs?
   b. What is the strength of that link?
   c. What is the nature of that link (e.g. mediation, causal, etc.)?
   d. What is the sign of the link (positive, negative)?
   e. Is there a difference between two groups?
   f. Is there a frequency?
   g. Is there a quantity?
2. What type of data do I have (nominal, ordinal, etc.)?
3. What kind of data do I have (independent? Metric or parametric?)?
4. How many variables do I have?"

The researcher should not produce and confirm hypotheses until he can respond to these questions. For regressions, he also has to determine the normality of the population and of the residuals because regressions are based on a normal law. Many studies forget to test the residuals—this is a mistake.

It is also strongly recommended that the researcher does not initially analyze the data directly by computing it into software such as SPSS or Amos. He should spend a few hours looking at it. He wants to develop a feel for it; he can even do some computation by hand. That technique is part of the data percolation methodology, because it allows the researcher to experience the data rather than plotting it without understanding it in the hope that the software will do the job it is supposed to do. It will, of course, but it will not give the researcher the gut feeling that is so essential to data percolation.

8.6 Distributing the Questionnaire

Sending questionnaires by mail or e-mail can make sense: it is relatively cheap and it avoids contact with the respondent if that is what the researcher is trying to do (in order to pretend to be objective—or be a so-called "positivist"). However, it contains one flaw that should be acknowledged (but that seldom is) in any study that uses this method: the researcher has absolutely no guarantee that the person who claims to have filled out the questionnaire is actually the person who did it, and he has no control over the length of time it took the respondent to do so (it could take 3 days, during which the participant's state of mind certainly changes).

There is another option, which is a basic technique of data percolation methodology. It is called the *live-distribution questionnaire*. In the author's research with seven car dealerships, the author physically went to the waiting rooms where customers were waiting for their cars to be fixed. He would then talk to them and explain he was doing a study (saying he is a student automatically arouses some sympathy) and that he would like to borrow 10 mins of their time (time wasted waiting anyway) to fill out a questionnaire. In 3 weeks, he had more than 200 names. Chances are that questionnaires sent by mail (or even by e-mail) take longer to come back to the researcher.

The live-distribution approach achieves a number of objectives: (1) the researcher is sure the person who fills out the questionnaire is indeed the person who fills out the questionnaire! (2) he can measure the time it takes to fill it out (if customers take too long, he can push a bit by saying he has to go); (3) he can check whether what the respondent answers in the socio-demographic section of the questionnaire corresponds to what he sees (on a few occasions, women who looked well into their sixties responded that they were 40 years old); (4) many times, respondents will come and talk to the researcher after completing the questionnaire. These customers feel obliged or are intrigued and want to express their opinions: this is a gold mine. The quantitative and qualitative data are collected at the same time—data that the researcher can cross-check on the spot! Also, most of the time, grumpy customers will not answer a questionnaire, so the researcher misses an opportunity to have contrasting cases in his data (a fact which may explain why the Customer Satisfaction Index ranks satisfaction high, yet sales remain poor). By seeing other people happily filling out the questionnaire, some (not all) of these unhappy customers

will take it upon themselves to follow the crowd. This method can be used when doing research on the psychological predisposition to buy in a mall, for example. The same applies to playing at the casinos: are people bored at home with the result that they try to step out of solitude by engaging a mechanical relationship with a machine? Or else, do they dream of riches and force themselves to believe that luck is on their side, no matter how poorly they fare in the end when gambling? Or are they already addicted to some games and express their distress by spending money without clear, realistic objectives? Providing the casino owner would be open to the idea of a questionnaire being filled out by the patrons, a live-distribution questionnaire would provide a wealth of information.

8.7 Conclusion

As can be seen, quantitative methods were discussed in a general manner. Errors that are frequently made were discussed; they have no place in the data percolation methodology. For the researcher, not determining the kind of research he wishes to do, not meticulously preparing his questionnaires and his scales and not identifying and formulating his hypotheses and data are not a recipe for rigor.

8.8 A Short Clinical Case

“Some patients express surprise at the fact that I do not take notes while in a therapy session (I take notes immediately after it ends, however). For some patients, it is perceived as an act of benevolence: they feel I pay full attention to their story. For other patients, however, it might be viewed as somewhat troublesome: they might think I do not care about their story. Hence, from this perspective, the fact of not taking notes is a moderating variable.” (Claire Poulin, psychologist, 2014).

8.9 A Few Questions

A few questions
Has the psychometric value of the questions on the questionnaire been reviewed?
Have hypotheses been aligned with the type of research the researcher is aiming to do?
Has the researcher considered sorting his data according to their characteristics (e.g., continuous, independent, etc.)?

8.10 A Few Keywords

Type of connections	Type of arrows
Arrows and types of research structural (*S)* and functional (*F*), (*D*) = (descriptive) binary (*Sb*) continuous (*Sc, F*) influence (*I*)—positive or negative (relational) direct (*I* + or *I*–) indirect … mediator (*I* + or I–)	Indirect … moderator (*I* ±) longitudinal (*T*) (predictive) (*T*) or (t) causal (*C*)—positive or negative (*C* + or *C*–)
Live-distribution questionnaire	A technique belonging to data percolation methodology whereby the researcher distributes the questionnaire in person and tries to collect qualitative information at the same time
Moderating variable	An external factor that influences the strength of the bond between an antecedent and a consequent variable
Mediating variable	A variable positioned as an alternative path to the direct path between an antecedent and a consequent variable

8.11 A Few Tips

The researcher should:

- Read a book on quantitative methodology
- Identify all the parameters of his quantitative research, hypotheses, scales, and data
- Not arbitrarily create questions in a questionnaire
- Not work on the basis of a faulty model

Chapter 9
Steps to Finalizing the Research

9.1 Introduction

The researcher is here on the map to evolution (Fig. 9.1):

Deduction is the art and science of interpreting results, of seeing whether they can be extended to different spheres of human activities. There are five ways of seeing reality as discussed in the section presenting the data percolation methodology. The five sources of information will give the researcher a different image of his emerging model. Table 9.1 illustrates this fact with the consolidated model of predation (CMP), which examines the emotional bond between a financial advisor (prompted to financial predation) and his client:

All these different ways of looking at an initial template model were leading towards the final consolidated model of predation (CMP) (Fig. 9.2 applied to a business exchange):

This was not the final model, however; it was merely the initial template as it found different expressions according to the different viewpoints. For sure, a very rich model was developing; the final stages of data percolation were yet to be performed.

9.2 The Nine Steps of Data Percolation

There are nine steps to the final data percolation; they are not necessarily sequential:

Step 1: Cross Checking Data As many researchers know, triangulation, even if expanded, is a small portion of data percolation. The researcher has to continuously check and cross check all five sources and has to accumulate data for the purpose not of complicating his model, but rather the opposite: of making it as simple as possible, so that it makes sense to anyone reading it. He can also resort to tables to find out where the same message is found from one source to the other. As an example,

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O. Mesly, *Creating Models in Psychological Research,*
SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5_9

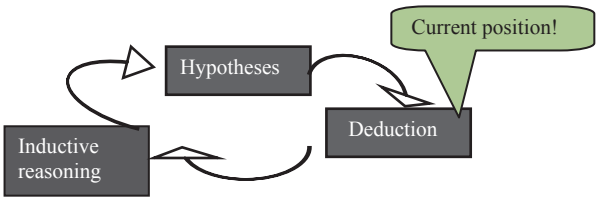
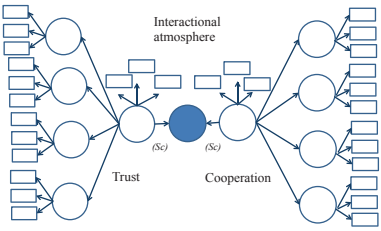
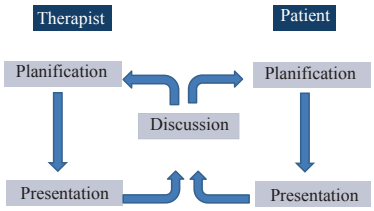
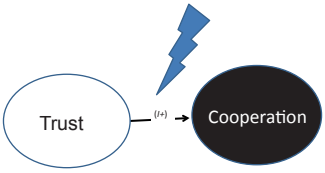
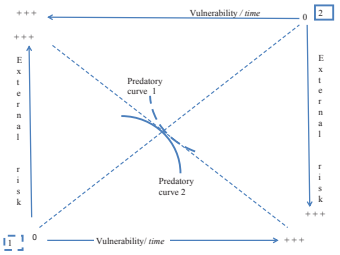
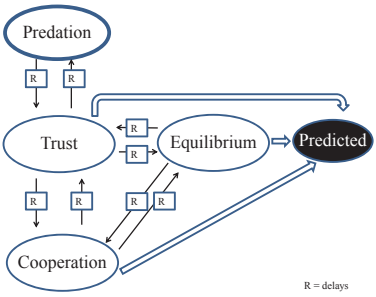
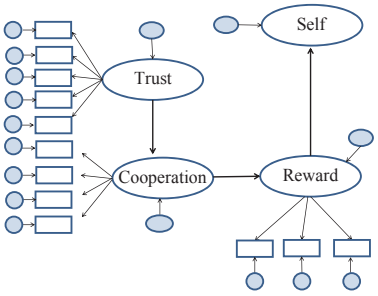


Fig.9.1 A road map to evolution—Part III

Table 9.1 Different ways of seeing the same reality

Emerging modeling using data percolation	Literature review (based on Ring and Van de Ven, 1994)
	
Qualitative	**Mathematical**
	
Simulation	**Quantitative: SEM**
	

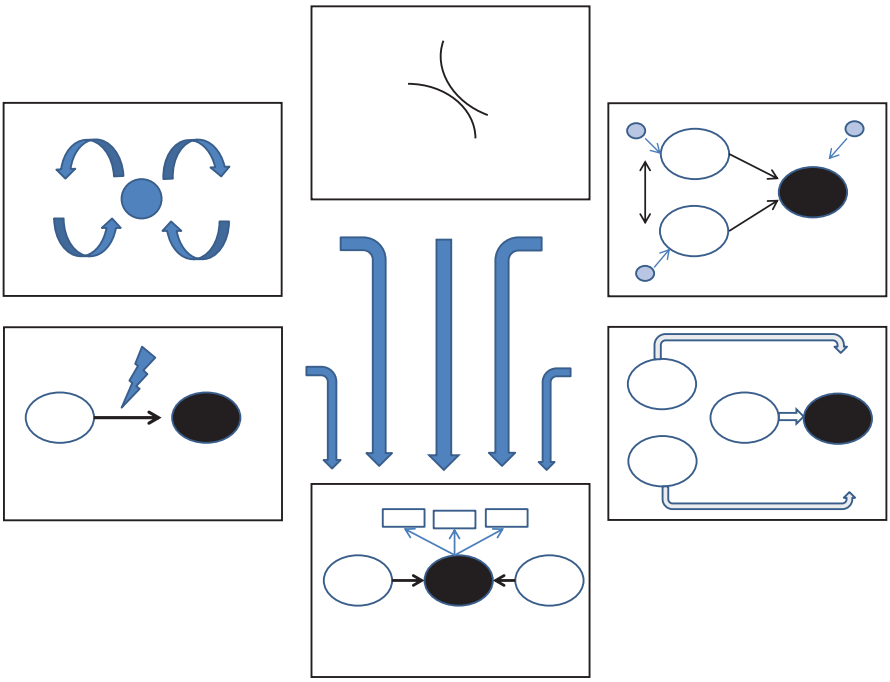


Fig. 9.2 The near-final CMP *before* final data percolation

the author collected these pieces of information when doing his research on the emotional bond between a salesperson and a buyer in a car dealerships (Table 9.2):

For the researcher, presenting his results in such manner will add a lot of credibility to his research, which is what he really wants to do. Judiciously quoting authors or respondents who say similar things serves to increase the researcher's credibility[1] when comes time to argue in favor of his model.

As the researcher looks at his data, he can return to past information and seek new information to corroborate his findings.

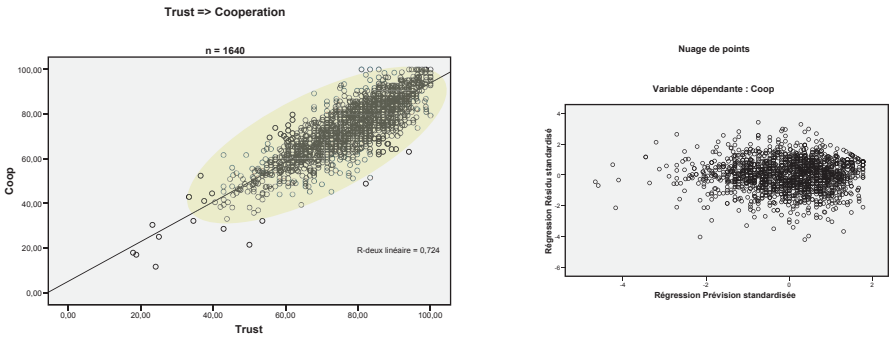
Let us take an example: trust and cooperation. Figure 9.3[2] shows one of the regressions the author obtained after running a single linear regression analysis based on 1640 respondents who completed the Mesly® questionnaire on perceived predation (perceived threat from another human being):

[1] An example: "From a managerial standpoint, buyers and sellers who understand the behaviors of their exchange partners are in a better position to foster constructive exchanges and avoid less productive encounters. Despite the importance of understanding selling encounters and exchange processes, there is very little, if any, research that empirically examines face-to-face interactions between actual buyers and sellers in the channels of distribution literature"(Jap, Manolis et Weitz 1999, p. 303).

[2] A French-language software was used.

Table 9.2 Data percolation on trust *versus* cooperation

Qualitative	Quantitative	Literature	Experts	Simulation
"Trust is needed in order to cooperate" Focus group 1	R^2 at 0.82	Anderson and Narus (1990): 0.73	A psychologist: "trust and cooperation go hand in hand"	Trust and cooperation are mutually dependent



R^2= 0.72; F = 4292.039; *p*= 0.000 Residuals

Fig. 9.3 Trust=>cooperation (*n*=1640; population and resides are found to be normal)

Note, how beautiful the regression is because it has an elliptic shape—an ideal shape for a regression line using the least-squares method. As can be seen, the coefficient of determination R^2 of 0.724 is excellent and just about equal to what other authors obtained in somewhat similar studies (Anderson and Narus 1990, has a value of 0.73; Palmatier et al. (2006) did a meta-analysis and concluded that 90 % of the studies on the subject confirmed the link between trust and cooperation).

The regression line tells the researcher that there is a linear relationship between trust and cooperation, but does not give precedence to one over the other: the researcher could have run the regression cooperation=>trust. Following the analysis of interviews' verbatim responses and participative summaries at least partially let him to decide that trust was the dependent variable (on the *x*-coordinate), concluding that, in the final CMP, trust and cooperation would even be chained variables during a point in time in an particular encounter.

The more trust increases, the more there are cooperative efforts, and vice-versa. When the author ran some more regressions, he obtained the following model using linear regressions (not SEM) (Fig. 9.4):

In essence, it seemed to show that the researcher's variables (bubbles) belong together, the R^2 (e.g., 0.690 in the above Fig. 9.4) pointed in that direction. However, the perceived predation variable showed very weak R^2. This gave the researcher an indication that it did not belong exactly there. When he did some more research, he realized that the most significant impact perceived predation had was towards trust. Why? Because trust is the willingness to make oneself vulnerable to someone else

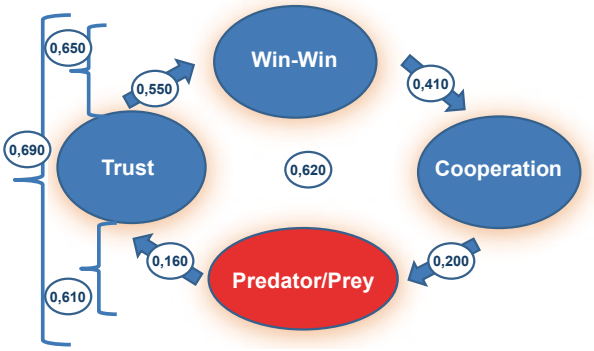


Fig. 9.4 The emerging consolidated model of predation (CMP) using single and multiple regressions

Table 9.3 Numbers and words

Said with numbers	Said with words
Product = criteria of choice # 1	"I enjoy looking at cars" "Staff care about my car"
Dealership name	"The owner is just a proud SOB"
General atmosphere	"People are friendly here" "People are helpful here"
Benevolence	"They're always like this here?" (Serving coffee, etc.)
Feeling of control (prey)	"They're there to rip us off"

whom one believes is well-intentioned towards him/her[3] and predation is the act of taking advantage of someone else's vulnerability, by surprise.[4] It made the most sense to position what became the perceived predation construct in a directional, one-way influence over trust. The perceived predation construct correlated well with perceived threat construct vastly used in psychology, with the exception that it is applied specifically to the interaction between two human beings, one of whom would have psychopathic tendencies.

A similar model exists in the case of psychotic illness. Fett et al. (2012, p. 976) "show that patients with psychosis and healthy relatives with a heightened risk for the illness exhibit lower baseline levels of trust compared with healthy controls. This effect partly overlapped with a reduced general intelligence." In short, lower trust, what is called in the CMP "equilibrium" (cognitive appraisal of situations from a perspective of fairness), and social integration ("cooperation" in the CMP) all are interconnected and trust seems to be the source of this particular dynamic.

One last example, taken from a study on emotions experienced by clients with a series of six car dealerships owned by the same person (Table 9.3):

[3] Lewicki et al. 1998, p. 439

[4] A surprise can be pleasant, or not pleasant (contrasting case) even if it was done with good intentions (Vanhamme 2008, p. 116).

In this case, the researcher has paralleled what participants told him during qualitative interviews with what statistical analyses revealed. He then searched the literature to confirm each one of these points[5]: obviously, he was not going to find in the field exactly what he was prepared for; hence, it was his duty to verify whether these findings were corroborated by past research which he was not acquainted with.

So, step number one of the actual data percolation is to identify the commonalities among the different pieces of data emanating from the different sources the researcher has investigated.

Step 2: Identify Contrasting Results The researcher wants to define white by white and black, and he wants to work with contrasting cases. If he is lucky, he can sometimes obtain results that contradict each other: one source says something, the other something completely different.

For example, Anderson and Narus claim cooperation comes first, that it is an antecedent to trust, when in fact the majority of other scientific literature posits the opposite. So the researcher needs to investigate: in this case, Anderson and Narus' claim cannot be sustained because their research was not actually longitudinal.

Contradicting data may be an opportunity to find rival explanations. Authors like Yin (1999), Patton (2002), and Miles and Huberman (2003) have all pointed out the importance of rival explanations, and examining them is a proof of rigor in psychological research. It could be, for example, that the 504 participants in the Anderson and Narus study were only those who had not experienced considerable conflicts with their business partners so that the results obtained were somewhat skewed towards positive relationships. Looking for rival explanations based on contradicting information helps the researcher put past scientific research in perspective and current data within a context (maybe what he finds in a particular case does not apply in a contrasting situation) or within their limits[6] (which is a great step towards defining his constructs).

Step 3: Identify Emerging Concepts As the researcher works with his data, he will venture in all kinds of different research tracks. Taken in isolation, in the context of a group discussion, for example, a theme may not mean much. But if it reappears even slightly while he digs into other sources, he may well discover an emerging

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[5] Examples: "Successful behavioral exchanges are accompanied by positive moods and emotions, which help to cement the experience of trust and set the scene for the continuing exchange and building of greater trust"(Jones and George 1998, p. 536). "First, generalized distrust continued to exert a negative influence despite the opportunity to directly examine the second product, and these effects were actually augmented to some extent." (Darke et al. 2010, p. 347) "…when partners feel that they are powerless to change anything in the relationship, frustration often builds…" (Bobot 2010, p. 299).

[6] To do too much (overservicing) can even be perceived negatively (Pine and Gilmore 1998, p. 104).

concept or even a trend. The CMP needed to be completed with a mega-construct—that of "atmosphere" —, after the researcher completed his investigation with the five sources and re-read his data. What put him on track was a factorial analysis[7], which systematically showed (across more than 40 groups) that when trust, cooperation and equilibrium were nearing 1, perceived predation (a calculation of weaknesses over strengths) was getting closer to 0, and vice-versa. It became clear in his mind that trust, cooperation, and equilibrium were structural components of atmosphere (a positive one, opposed to conflict); he already knew that equilibrium was a mediating variable between trust and cooperation and that trust and cooperation were chained variables at some point in time. His model was starting to make a lot of sense, to become very rich. He added the construct of atmosphere in his model and focused on relationships and interpersonal rather than transactional dynamics.

Step 4: Identify Patterns, Trends or General Laws Based on the researcher's data with respect to the research on the CMP, a number of general observations were generated. They were called "laws" because they seemed to appear systematically throughout all of the groups that were analyzed over the course of more than 5 years; they were vivid examples of pattern matching[8] that could not escape the researcher's critical analysis:

1. The more there is perceived predation, the less trust and cooperation takes place.
2. The higher the levels of trust, cooperation, and equilibrium, the better the working or negotiation atmosphere is between the provider of a service and his client. This leads to the law of perceived predation: the more one party perceives the other party as a predator, the worse the level of trusts, cooperation, and sense of win-win will be.
3. The higher the interaction level (interpersonal as opposed to relational or transactional), the better the discussion atmosphere.
4. Yet, the more interpersonal the relationship is, the more potential or actual predation can take place (because vulnerabilities are known.)
5. The levels of trust, cooperation, and equilibrium seem to average out over time (the researcher did a small longitudinal study to arrive at this conclusion).
6. Parties tend to focus on one of the three interaction levels at a time (transactional, relational, or interpersonal).
7. As soon as the level of perceived predation (prey/predator) is equal to or higher than 1, the relationship becomes conflict laden.
8. Perceived predation takes place between two limits: the inferior at a level of 20% (1.5/7) and the other at a level of 60% (4/7) where 7 is the maximum level based on a 7-point Likert scale.

[7] According to Nunally (1970, p. 151), factorial analysis is at the heart of psychological measures.

[8] Yin 1997.

The researcher could thus see trends or patterns across the groups and what he learned from qualitative measures. It looked like the CMP was making sense and could be developed into a model of sexual predation (CMSP).

Step 5: Seek Hidden Truths Not all things can be voiced. People do not know that they have secrets deep in their mind, or else they do not want to disclose them (who would want to admit that they are a predator?), or else they are not able to express them. It could also be that societal norms prevent the expression of these secrets (e.g., incest). By looking at a phenomenon from five different angles (the five different sources), the research sheds light and minimizes the dark spots. It is like looking at a rock on the ground. If the researcher looks at it from the sun's angle, he will probably guess there is some shadow somewhere around it. If he looks at it from various angles, he ensures he leave no uncovered dark spots.

As can be guessed, not everyone will talk about being prey, or else will admit to being vulnerable. Yet, being a prey can serve many purposes and turn out to be a winning strategy. The boxing match between Muhammad Ali (Cassius Clay) and George Foreman in Zaire in 1974 provides a vivid example. Ali became Foreman's prey for eight rounds, before knocking him out, when Ali determined his opponent had exhausted all of his rage. If Ali had revealed his plan to anyone ahead of the fight, he most likely would have lost. He had a hidden truth (and it served him well).

So, the researcher specializing in data percolation is after some hidden truths just like a clinical psychologist tries to help his patient to open up. One of such hidden truths could be people's hidden vulnerability. Hidden truths cannot be uncovered by directly asking a question about them: it almost amounts to asking a petty criminal whether she/he has stolen the beer bottle off the shelf, yes or no. Chances are the thief will answer "no," even if aware of being caught on camera. In Anderson and Narus (1990)'s questionnaire, one of their questions about conflict is quite straightforward: "Disagreements between Manufacturer X and our firm have ____ (*to fill in*) the productivity of our working relationship considerably increased/considerably decreased." This approach is sterile from the point of view of the data percolation methodology.

In research on perceived predation, the hidden truth was more than the concept of predation; it was *perceived* predation—the idea that parties perceive others as potential predators and themselves as potential prey. Perception overrides reality. Perceived predation is to some human interactions what perceived threat is in general.

Step 6: Establish the Minimal and Maximum Thresholds As exemplified in Step 3, "law" number 8, data percolation allows the researcher to set some lower and upper limits. The idea of lower and upper limits linked to behaviors in psychology or social sciences at large is not new; other researchers have discussed it (e.g., Lichtlé and Plichon 2008, p. 133–134; Mattila and Wirtz 2000, p. 600). Mazar et al. (2008, p. 642) explain that there is a threshold point beyond which the relationship deteriorates (see also Csikszentmihalyi 2000, p. 270). Sometimes the threshold point can be very sensitive (remember when one cannot stand waiting in line at a bank).

For example, it became clear during the author's research that buyers expect sellers to come after them at least a little: if the seller, say Mr. Preet, spends less

Table 9.4 Some measures of some relationships

CLIENT (Code A_x)	Trust	Cooperation	Equilibrium	Strengths and weaknesses	Salesperson (Code V_x)	Trust	Cooperation	Equilibrium	Strengths and weaknesses
A_1	74	73	66	3.5/2.6					
A_2	78	76	79	3.5/3.0					
$A_3^{\$}$	85	82	87	3.3/2.8					
$A_4^{\$}$	81	79	90	3.4/2.9					
A_5	29	31	25	3/5.6					
A_6*	85	88	80	4.0/3.0	V_6*	86	82	82	4/2.6
A_7^{+}	78	75	76	3.3/2.7					
A_8^{+}	77	76	77	3.8/3.0					
A_9*	80	82	90	2.8/1.2	V_9*	86	96	93	4.2/2.2
A_{10}*	95	96	96	3.8/2	V_{10}*	86	91	89	3.8/2
A_{11} !	86	94	99	Na/na	V_{11}	59	56	68	3.2/2.6
A_{12} !	92	87	89	4/2	V_{12}	73	78	71	2.6/2.6

* High interpersonal level, $^{+}$, large groups, $^{\$}$ close groups, ! supervisor-student
Trust, equilibrium and cooperation in percentages, predator/prey on a 7-point Likert scale, Na = not available

than 20% of his time trying to hard-sell, he looks uninterested. If he spends more than 60% of his time pushing too hard, it looks like he is being abusive. There is a predatory comfort zone that the researcher could identify by looking at numerous relationships, some of which are listed with their construct levels in Table 9.4 (A_5 is clearly a contrasting case).

Identifying zones subsequently helped the researcher develop tools to more adequately measure his constructs and express their intricate functioning. Figure 9.5 shows one of the tools (the grid) that he used extensively thereafter in all kinds of interactional contexts.

The researcher found four zones of interest: one of an excellent atmosphere (interactional, relational, and interpersonal), one of indifference, one of conflict, and one of actual predation. Figure 9.6 shows a few examples of this grid filled out by real participants during a research using the data percolation methodology.

As can be guessed, the researcher used these results to go and see the respondents one more time and conducted another series of interviews, which, in the end, further convinced him of the validity of the CMP (which eventually turned into the CMFP when he focused on the financial sector and the CMSP when the model was applied to sexual predation). Seeking some of the key participants' feedback

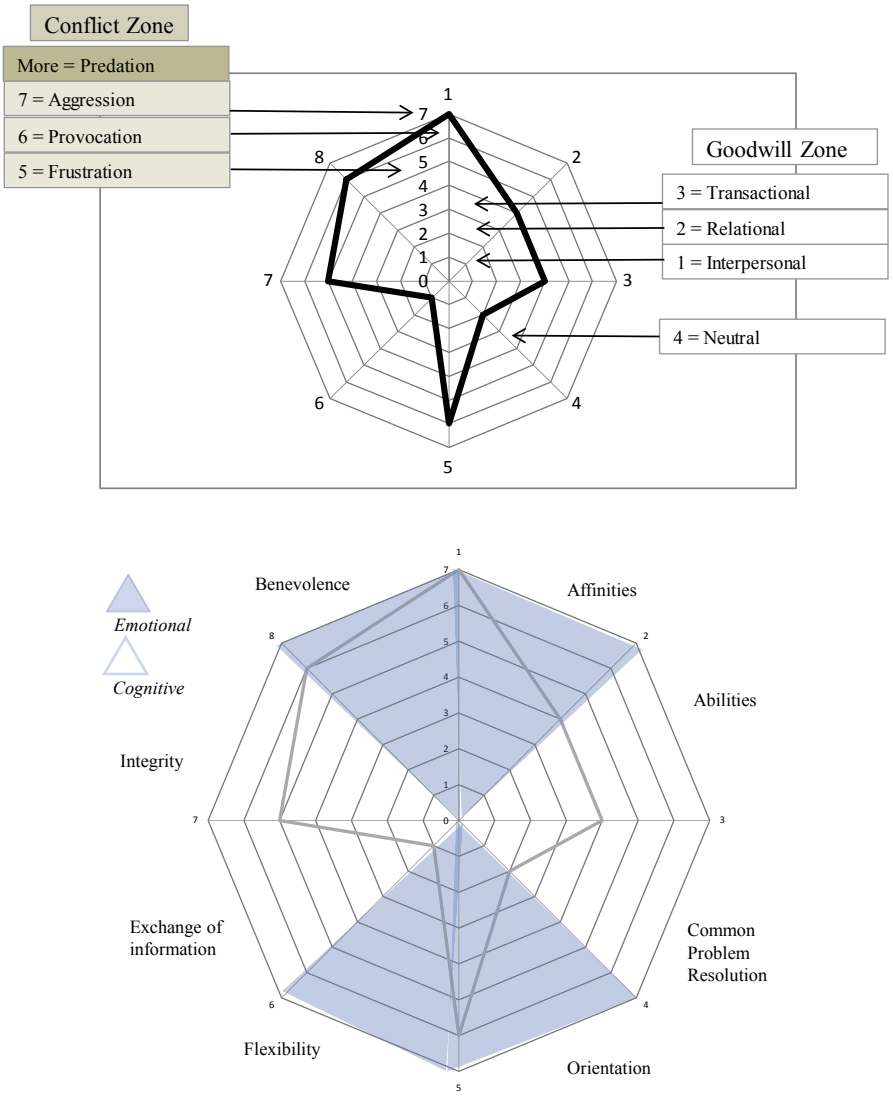
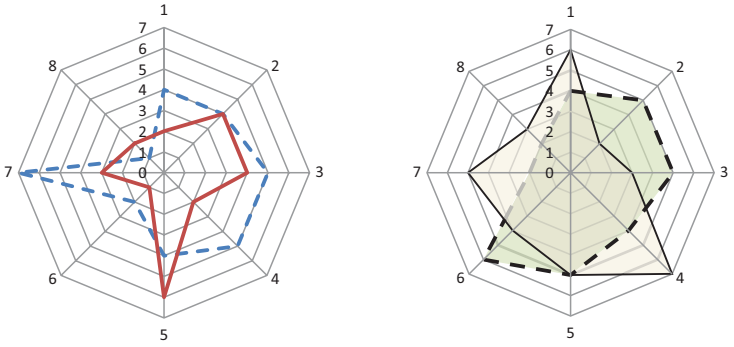


Fig. 9.5 The grid (This research was done in French)

is essential: ultimately, they are the best judges of the value and impact of the researcher's findings.

Step 7: Take a Step Back! Data percolation is a very intense and demanding methodology. It is highly recommended that the researcher takes some time off once in a while.

Step 8: Identify the Indifference Point From the above grid, one can see there is an indifference zone (the choice # 4 in the 7-point scale that was used).



Dotted line: perception of therapist by patient
Solid line: perception of patient by therapist

Fig. 9.6 Filled-in grids

When the author did one of his research studies, at the previously mentioned Toyota dealership, he discovered his questionnaire was too long. He had to shorten it because clients either did not want to or did not have the time to fill it out. If he had tried to impose his questionnaire beyond the patience limit of his clients, they would probably have answered anything just to put the task behind them and could potentially have complained to the dealership's management about him.

Similarly, a questionnaire may be found to be too invasive. The Mesly® questionnaire on love, for example, is quite intrusive as it delves into people's intimate feelings. It is an adaptation of the questionnaire on dyad relationships (e.g., clinical psychologist and her/his patient) with an investigation on an additional construct—that of intimacy—, and an additional situation—that of having an affair. So, clearly, not every couple is ready for each partner to fill out the questionnaire. There has to be a fair amount of trust towards the couple therapist. It may be that one of the partners in the relationship does not see fit to answer the questionnaire, thus developing an "indifference point" as a means of self-protection.

These are many examples of indifference points: past that point, people do not act the same way they would in normal circumstances. It may be that much research that is published in scientific journals has been based on questionnaires that were filled out by respondents who answered anything to be done with the questionnaire (filling it out because of a sense of guilt or duty or curiosity, etc.). The answers are thus not valid. They tell of respondent's playing with the questionnaire, not what the respondents *really* think or feel about what is being investigated. This limits the research.

Not recognizing the indifference point is a grave error in the hypothetico-deductive approach. To notice it, it is sufficient to conduct a few semidirected interviews and see at which point the respondent becomes tired, annoyed, fed up or else triggered, upset or overly emotional. The researcher should not go beyond the limit of what the respondent is willing to do or capable of doing. This also applies to interviews with experts and quantitative studies.

Step 9: Pose the Six Questions of Data Percolation In order to assist the researcher in making sense of the data collected, six questions must be asked:

1. "Have I obtained similar results across the methods (when the respondent was close—qualitative study and far—quantitative study)[9]?
2. Have I obtained similar results with contrasting participants?
3. Are new concepts emerging out of the different results obtained through the various methods?
4. Does the information collected from one method help in understanding the results of another method?
5. Do I obtain a "clearer, more accurate and nuanced view" (Rocco et al. 2003, p. 26)? And finally,
6. Did I identify the indifference level of the participants? (Meaning, did the participants truly care about responding or did they simply answer anything that crossed their mind in order to get out of participating?)"

These six questions end the actual percolation of the data in the data percolation methodology. They must be answered. The researcher's objective is to produce research that has value, impact and is well supported, short of being able to work in a laboratory under fully controlled variables.

9.3 An Overview of Data Percolation

Data percolation is a methodological design that seeks to align data collected through five sources of information so as to offer a family of responses[10] to an initial problem, with the objective of producing rich and well-anchored explanations, models, and recommendations.

As an example, the author's thesis, which used the data percolation methodology, allowed him to (1) verify the existence of three interactional levels recognized in the literature (transactional, relational, and interpersonal[11]), (2) develop the concept of perceived predation (an extended version of the notion of opportunism), (3) understand the role and notion of interactional equilibrium (win-win), (4) clarify the four structural variables of trust (the scientific literature had identified them, but sparsely, never grouping them around the main concept of trust) and the four functional variables of cooperation, (5) present and define the idea of atmosphere (which had been proposed in the 1980s in relationship marketing, but without a full definition).

---

[9] Campbell and Fiske (1959, p. 83) state: "Validity is represented in the agreement between two attempts to measure the same trait through maximally different methods." Hence, answering positively to question 1 is an indication of validity.

[10] Sobh and Perry 2006, p. 1202.

[11] There is a fourth level—that of intimacy—, that was not investigated in the thesis.

Most particularly, data percolation offers ways of limiting, if not eliminating, research errors associated most particularly with personal bias, modeling, improper use of statistical tools (e.g., Cronbach's alpha), reliance on single sources of information, and erroneous assumptions. Data percolation limits the emergence of confirmation bias, whereby researchers find what confirms their assumptions; as explained, some researchers play with their model to fit the results or else play with the results to fit the model. The researcher using data percolation is wary of spurious relationships[12] whereby dubious relationships are made between concepts.

All in all, data percolation leads to the creation of a "clearer, more accurate, and nuanced view"[13] of the world under investigation. Often, the world of human behavior is subject to a stroboscopic effect: when one watches a movie in which a car travels at full speed, one at times sees the wheels turning in the opposite direction! The same phenomenon occurs in life: what seems to go in one direction may actually be heading in another. Hence, the need to perform a full, multiangle analyses is obvious.

Above all, data percolation is an enriching experience for the researcher; although not world changing, he will have developed analytical skills that will assist him during his entire life and will have met people from different walks of life, some of whom will remain acquaintances or even become dear friends.

9.4 The Final Model

During the course of the research, the "final" model[14] in its most simplified form that came out of the author's research which involved over 1600 participants was this (Fig. 9.7):

The model resembles that of Clark (1986) whereby a stimulus generates a perception of danger, which then provokes anxiety (emotion/trust), an interpretation of catastrophe ready to happen (cognitive effort/equilibrium), and physiological reactions (conative/cooperation).[15]

Clearly, when there are no reasons for perceived predation (perceived predation = 0: primary appraisal) to take place and no pre-apprehensive mechanisms (Barlow 2000), what happens is very much according to Phillips et al. 2003's model: first, there is a stimulus (which does not generate a fear emotion), which is then assessed, which then produces an emotional and conative reaction, leading to some

[12] Neuman 1994, p. 109.

[13] Rocco et al. 2003, p. 26.

[14] It is never final, but at some point, one must hand in the thesis or the paper!

[15] Note that there is a double-oval (bubble) around the constructs of trust and bonding because each one is composed of sub-constructs, as seen before. Note also that the starting point (perceived predation) has a bolded outline oval (bubble) and that the end point is filled (just like a period at the end of a sentence).

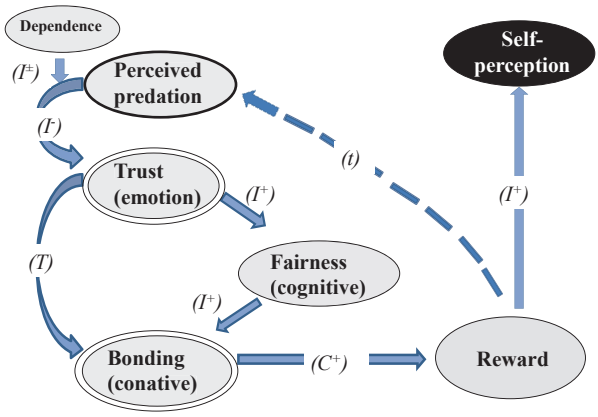


Fig. 9.7 The final consolidated model of predation (CMP)

self-regulatory effort. Once the stimulus is deemed a threat (perceived predation > 0; secondary appraisal), then a fear reaction immediately kicks in, followed by cognitive and conative efforts to cope with the associated stress. The CMP (Fig. 9.7) can be presented in a much more complicated way by adding the ten structural and functional variables of perceived predation (five *S*, five *F*), the four structural variables of trust, and the four functional variables of cooperation. One would also add the three observables for each of the variable.

As can be seen, the researcher assumes that perceived predation affects trust immediately because of the fact that predation targets others' vulnerability, and trust is accepting to be vulnerable with the expectation the other will act ethically. Trust and cooperation are no longer assumed to be chained variables: they influence each other almost instantly, but through a complete loop (*t*). Thus, the *starting point* of this model is perceived predation (bolded oval/bubble). A model should always have one and only one starting point.

Equilibrium is a mediating variable. It has been moved slightly to the right because it is an influence variable (it has a time component); and such presentation for a mediating variable is found in the literature[16]. Together, trust, cooperation and equilibrium are structural variables of the interactional atmosphere. The *end point* is the construct of self-perception (filled-in bubble). All models should have one and only one end point.

A self-sufficient model is called a *module*, after the theory of brain modules which stipulates that the brain works much like a set of Lego blocks and not in compartmentalized sections.

One can summarize the entire research by looking at the model *after* final data percolation (Fig. 9.8 in a business context).

For the researcher, it was worth going through the various steps of data percolation for two reasons: (1) he saved a lot of time because he avoided many errors and focused on the subject at hand, and; (2) he ended with a sense of accomplishment.

[16] Sousa et al. 2010, p. 3.

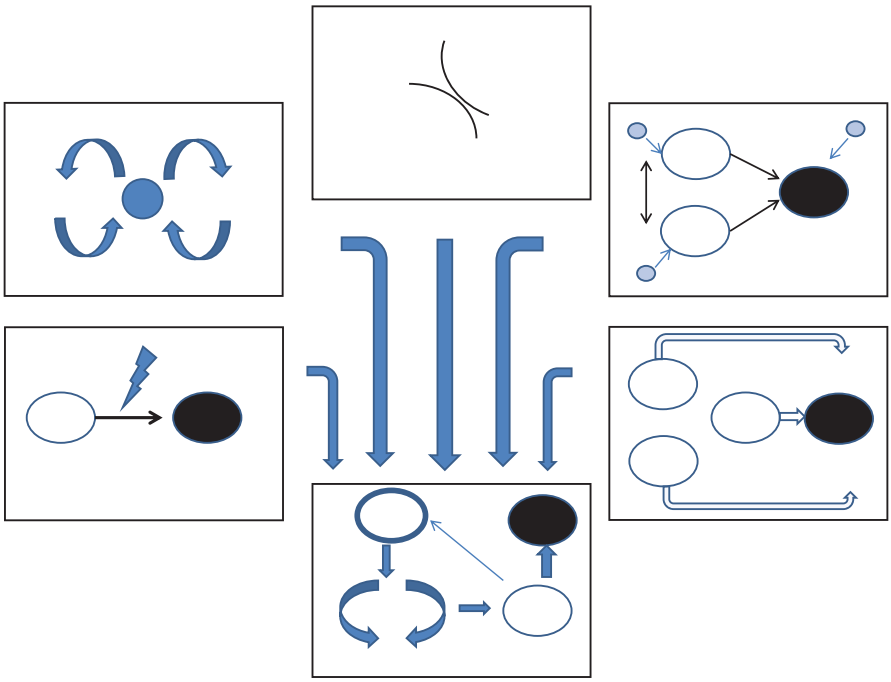


Fig. 9.8 The consolidated model of predation (CMP) *after* final data percolation

9.5 Conclusion

This chapter has hopefully demonstrated the value of the data percolation methodology. The purpose of a thesis or paper is to break new ground and expand one's research skills: data percolation provides a series of steps that help the researcher grow through the process of writing a masters or doctoral thesis or, perhaps, writing an article. The researcher started with adopting the right attitude and the creation of a template through proper modeling, including articulating the constructs' definitions with contrasting cases, generating bubbles and arrows. One saw that the researcher could achieve this by taking advantage of five sources of information and some efficient tips for improving data collection were proposed. The researcher wants to outline ways of limiting, if not avoiding altogether, errors commonly made in social science research. Finally, systematic steps to analyze the data was devised, so that the researcher could feel reasonably sure he had produced rich content that has all the elements of validity. With rich data, the researcher produces rich content,[17] providing proper rigor supports his effort. In the example above on the CMP, the author finalized the template model.

[17] Charmaz 2006.

9.6 A Short Clinical Case

"I realize I can use modeling in my private practice. For example, I had a case of a recently emigrated father who was suffering from high anxiety with respect to the risks that he could envision his child was exposed to in his new daily life, with all of its cultural differences (probably a moderating variable). This caused the father a sense of unease (causal link) which then led to some conflicts with his wife (time factor). His perception tended to be aggravated by OCD tendencies (influence) which then made him even more anxious (retroactive loop). I could sense that this dynamic stemmed from low self-esteem, especially as a father, a fact that may have had its origin in his upbringing as a neglected child back in his country of origin (influence). My plan of action was at first to bring the father's self-esteem to a functional level." (Claire Poulin, psychologist, 2014).

9.7 A Few Questions

1. Any model, in the data percolation modeling system, begins at one and only one starting point (bubble): true or false?
2. Any model, in the data percolation modeling system, ends at one and only one ending point (bubble): true or false?

9.8 A Few Key Words

A few key words	
Module	Self-sufficient model composed of at least two bubbles (variables)
The nine steps to percolation of data	Cross check data Identify contrasting results Identify emerging concepts Identify patterns, trends or general laws Seek hidden truths Establish the minimal and maximum thresholds Take a step back Identify the indifference point Ask the six questions of data percolation
The 6 end questions	"Have I obtained similar results across the methods? Have I obtained similar results with contrasting participants? Are new concepts emerging out of the different results obtained through the various methods? Does the information collected from one method help in understanding the results of the other methods? Do I obtain a "clearer, more accurate and nuanced view"[18] Did I identify the indifference level of the participants?"

[18] Rocco et al. 2003, p. 26.

9.9 A Few Tips

The researcher should:

- Verify his results with a new look at the literature.
- Follow all nine steps without skipping any.
- Take a break once in a while.
- Validate his results with participants in the field.
- Not play with the results.
- Not assume his research is over: it is never over!

Chapter 10
Writing

10.1 Introduction

Writing is no easy feat[1]. Most scientific literature uses the passive form (as this book does at times), and sometimes resorts to complicated words and constructions, as well as long sentences.

The researcher's goal should be to understand what he is doing and make other people understand what he is doing. This is why, prior to defending his thesis, he must present it in a format acceptable to all (including the participants) in a public forum: this will be the reality check as to the value of his research.

Also, he should use linear thinking and keep his presentation consistent with his main theme from beginning to end.

There are a few more things he should do that will help enhance the quality of the work he has accomplished thanks to the data percolation methodology and that will add a lot of credibility to his ideas: grounding, applying rigor, focusing on proficiency, and building credibility.

10.2 Grounding

People (the supervisor, the members of the evaluation committee, the audience in public presentations, readers of the article, etc.) are often trained to criticize and test the researcher to ascertain if he can defend his position. Some people go a bit overboard: they will use insults, insist a bit too strongly, tell him what to do and what he should have done and so forth. It is legitimate to question someone else's

[1] See Garman 2011.

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SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5_10

scientific work. The researcher's best defense is to anchor securely his entire research project[2].

To give an idea, the author anchored his research on predation in several areas. In terms of context, he looked at General Motors (GM) and found out that it had a long history of antagonistic relationships with its dealerships and was even in violation of antitrust laws in the 1930s. According to Clarke (2003, p. 61), "The three parties—consumers, dealers, and management—faced tension to the extent that one party's profit came at the expense of another party." There was a history of conflict within car dealerships, so the researcher was justified in conducting an investigation into that area of economic activity.

To associate himself with psychological trends such as neurolinguistic programming (NLP), the researcher could rely on the work of researchers in the field and point out the differences with other approaches.

He also could look into other disciplines, such as neurobiology—in the author's case, if he could hint at a neurobiological basis[3] for his consolidated model of predation (CMP). As mentioned throughout this book, Anderson and Narus 1990s' model was used as a starting point. A few studies served as examples of what could be done: those of Brennan et al.[4] (2003) and McFarland et al.(2006) in particular[5]. The author certainly relied heavily on grounded theory in developing data percolation[6]. He verified that Baron and Kenny's (1986) method for identifying mediating variables was widely used in his area of investigation[7].

The following are key elements of a thesis where the researcher can and should seek to anchor himself:

---

[2] Be wary, however, of plagiarism. Simply identify your sources at all times, even for short expressions you borrow from an author. Equivalently, you work hard for your research project and should expect to have your authorship protected.

[3] The author found that the limbic system plays a role in building trust and the amygdala plays a role in fear and sensing danger (Hedgcock and Rao 2009, p. 3), aggression, the survival instinct, and social judgement; that the anterior cingulate cortex is involved in autonomic functions (for example, blood pressure) including error detection and conflict evaluation (Glimcher and Rustichini 2004, p. 452); that the caudate nucleus is linked to trust (King-Casas et al. 2005, p. 82). Some studies show that the neurological signal for the intention to trust appears earlier when participants meet several times (Miller 2005, p. 36). De Quervain et al. (2004, p. 1256) mention that, "Taken together, our findings suggest a prominent role of the caudate nucleus, with possible contributions of the thalamus, in processing rewards associated with satisfaction of the desire to punish the intentional abuse of trust."

[4] Brennan et al. (2003, p. 1646) write: "empirical data should be collected from both sides of the dyad, and can be thought of as a form of 'within-method triangulation'".

[5] McFarland et al. (2006, p. 108–109) write: "In the first phase, we obtained a customer list for each dealership from the dealer's parent organization. This list included the names of three customers per dealership. […] In the second phase, we mailed questionnaires to the 290 salespeople that customers in the first phase identified. To ensure we obtained matched dyads, we provided each salesperson with the name of the customer who identified him or her and asked the salesperson to respond to all questions with the specific customer in mind (we did not reveal customer responses)".

[6] See Glaser and Strauss 1967.

[7] See Annex A of Mesly 2012a.

- A context.
- A trend.
- A concept.
- A model.
- A methodology[8] (the data percolation methodology is recommended of course).
- An existing study (see Annex E).

Researchers using the data percolation methodology thus must anchor their research in a context, a trend, a concept, a model, and an existing method. Doing otherwise means partially disconnecting himself from reality. He has to start with what is there and improve it.

10.3 Rigor

Rigor is maintained through three general principles: (1) discrimination; (2) saturation; and (3) parallelism.

Discrimination refers to the ability to find relevant information and relevant sampling for a research. Saturation has also been discussed and refers to the ability to reach a point where the researcher needs not collect any more data or seek additional participants.

Parallelism means giving equal weight to all elements in a series. In the following sequence, for example, there is a breach of parallelism: This therapist is (1) good, (2) excellent, (3) old and (4) dynamic. The "old" choice refers to sociodemographic characteristics, whereas the other options refer to skills. Many questionnaires and articles are written with a total disregard for parallelism, which impedes the reader's understanding of them.

Parallelism is also crucial in modeling, and this is why: when the researcher measures constructs, he assumes that they are of equal weight. For example, when the researcher measures trust by its four structural subconstructs (affinity, benevolence, ability, and integrity), he works out an average. He wants his model to be as parallel as possible. This is why in the CMP, trust and cooperation each has four subconstructs and when one looks at the predation model (the predatory web, Fig. 8) and the emerging CMP (Fig. 21), there is a balance between the various components. Having parallelism in a text and the models is of tremendous help in expressing

[8] Grounded theory is improved in the following manner:

1) Identification of relevant constructs using a multidisciplinary approach;
2) Definition of constructs and progressive modeling (semantic, graphic, mathematical, and computer-simulation modeling);
3) Identification and measurement of the observables related to the constructs;
4) Identification of connections between constructs;
5) Qualitative and quantitative iterative tests of definitions, connections, measurements, and validity;
6) Development of relevant laws and underlying theory.
7) Final check of data percolation.

ideas with clarity and in making decisions about what part of the data and model to keep or put aside momentarily.

As it has been seen, there are some magic numbers: a minimum of two constituent constructs when there is a need for them and observables in multiples of three if possible. Such an approach tempers the need to keep adding stuff to a model and a text so that they become overly complex.

These three criteria for assessing rigor are well known in multicriteria analysis, for example[9], where they are called (1) exhaustive check (saturation), (2) nonredundancy[10] (discrimination), and (3) cohesion (parallelism).

10.4 Writing Proficiency

Complex models, "aristocratic" sentences, excessive use of passive voice, big words ("utilize" instead of "use"), fancy construct names—none of these are a sign of rigor according to the data percolation methodology[11]. They are the equivalent of trying to make a good espresso without grinding the coffee beans. The researcher must write to communicate, not to cloister himself in a room[12,13].

Debate exists over positivism *versus* objectivism (in data percolation, the researcher just wants to be pragmatic) or over exploratory *versus* confirmatory research. Technically speaking, everything is exploratory and nothing can be confirmed; the researcher simply has to draw a line, take a stand, and proclaim, for example: "I am going to call this the theory of predation". For what it is worth, exploratory research seeks to generate ideas, determine the feasibility of a project, develop techniques,[14] and find out whether a given construct or phenomenon truly exists[15]. Confirmatory research cannot confirm *per se*; psychology, for example, is not an exact science. It merely allows researchers to validate the phenomenon being studied to the best of their abilities.

A theory merits being called a theory, if it has a law or general principles (e.g., in thermodynamics)[16]. According to Weil-Barais et al. (1997, p. 29), a theory is

[9] Pomerol and Barba-Romero (1993).

[10] This applies to questionnaires of course: no additive questions!

[11] Here are six problems in some publications: (1) an anti-pedagogical approach; (2) a disconnect with reality; (3) using trick dice; (4) using the hypothetico-deductive method with its inherent biases; (5) intellectual density; and (6) artificiality.

[12] Laurencelle (2005, p. 2) writes: Because science belongs to the public domain, it must be possible to exhaustively describe, communicate, and reproduce its knowledge and main content. (The author's translation).

[13] Podsakoff and Dalton note, in 1987, a general unease with scientific writing.

[14] Neuman (1994, pp. 19, 20).

[15] Dane (1990, p. 5).

[16] Lamoureux (1992, p. 15).

precise, adjusted to experimental data, rich in consequences and impact, as well as simple in its structure and intelligibility.

Again, the best test to ensure the researcher is using an intelligible level of language is to conduct a reality check before a general audience. This will force him to simplify whatever complexities still hamper his ability to communicate. The researcher can invite his participants to attend; it concerns them first and foremost, so he owes it to them! The researcher is not writing to tell people (including therapists) what to do (in fact, the reverse may well make more sense)[17].

That said, there are a lot of good articles and good sentences or paragraphs the researcher can borrow from to support his thesis. Annex E gives a few examples relevant to the ideas discussed in this book.

10.5 Credibility

When the researcher writes, that is, when he puts the final touches on the work he has done toward completing his master's or doctoral thesis, or article, his first objective is to be understood. Writing is teaching. However, if the researcher has no credibility, no one will learn what he is teaching, even if it is of value and is true. So, really, first he establishes some degree of credibility, and then people will listen to him and read what he writes. Scientific articles are written in much the same way: the abstract is essentially there to make the reader believe that the writer is credible enough to justify reading another line, and then another one, all the way to the end.

Before the researcher worries about validity and reliability, he should really consider how credible he sounds. He can establish his credibility by doing a thorough analysis, that is, by appropriately defining his constructs, building a solid, well-balanced, logical model, establishing the limits of his research (including his own personal limitations), looking for rival explanations, and being systematic in performing qualitative and quantitative analyses. He can quote authors and he can use real-life examples to show that what he is investigating is not smoke and mirrors. In the play (or movie) *Twelve Angry Men* (Rose 1954), the one juror who does not think the accused is guilty beyond all reasonable doubts (and who needs to convince the other 11 jurors that they should change their minds) actually went out in the field so to speak: he bought a knife in the neighborhood where the alleged knifing took place, even though he was not allowed to do so because of his duty as a juror. He then started to question the validity of some of the evidences and the motivation of some of the witnesses. New facts came to light and what was there all along suddenly revealed itself, as if by magic: the key witness would have had to have been wearing her glasses in order to have seen what she claimed she saw.

[17] Example: on pages 1542 and 1545 of Dagger and O'Brien (2008): "As a means of retaining customers, firms must understand"; "marketers should focus"; "strategies should focus"; "it is important that service firms understand".

If the researcher is confused about validity and reliability, he need not worry. In actual fact, very few scientific articles in psychology can prove the validity (the research can stand its ground; it is not filled with errors), let alone reliability (what was measured could be measured again and again without the results varying, if all the conditions were the same), of their research. Some authors even create new forms of validity[18].

True, the researcher can run some statistical tests, such as discriminant validity, and true, they are useful: he can, for example, determine if some constructs are sufficiently different from one another. But all validity tests should be treated like Cronbach's alpha: taken with a grain of salt. These tests are there to help, not to make a final judgment.

There are four types of validity that are often used in social sciences literature in particular: convergent, nomological, internal, and discriminant. However, in data percolation, a fifth one is included: *instrument validity*. This means that the instrument measures what it is supposed to measure and is used in the way it is supposed to be used. This applies to such things as the questions in one's quantitative questionnaire and the use of Cronbach's alpha.

Podsakoff and Dalton noted in 1987 that fewer than 15% of studies make an effort to enforce validity. Validity is sometimes questioned in the case of self-administered questionnaires because of a desirability effect (the respondent is trying to please the distributor of the questionnaire), but they are vastly used (hence, the scientific community accepts its limits) and some authors even suggest that social desirability does not impact predictive validity (although one should really be talking about predictive power instead of predictive validity) even for criminal offenders (e.g., Kroner et al. 2006). As for reliability, it is seldom mentioned in scientific papers, the reason being that experiments are rarely replicated.

Table 10.1 proposes some strategies to deal with the most common types of validity; as one can see, they are all related to the techniques that form the data percolation methodology:

10.6 Conclusion

The data percolation methodology is a system for building credibility, validity (in all of its common forms), and reliability. Conducting the available statistical tests (e.g., discriminant validity) with proper caution will only enhance the researcher's credibility; it will not make him look weaker. The use of data percolation will do the job of proving he has worked rigorously.

[18] Example: Scandura and Williams (2000, p. 1253) refer to statistical conclusion validity. Tashakkori and Teddlie (2003, p. 13) propose a crystalline validity and a systemic validity.

Table 10.1 Validity and reliability

Type of validity[a]	Strategy
Convergent validity	Find a chain of evidence through multidisciplinarity; consult experts[b]; focus on providing a sound definition of variables
Nomological validity	Compare results to previous studies
Internal validity	Find the significant observables; find the significant connections between the variables
Discriminant validity	Examine correlations among observables and among constructs
External validity	Study contrasting cases
Instrument validity	Verify that the measuring instrument measures what it is supposed to measure and is used in the way it is supposed to be used (e.g., the questions in the questionnaire, the use of Cronbach's alpha)
Reliability	Conduct longitudinal studies

[a] See Cronbach and Meehl 1955
[b] Fisher et al. (2010, p. 327) suggest that consulting experts may help researchers better define constructs

10.7 A Short Clinical Case

> "Of course, when a patient comes to see me, something is likely troublesome in her/his life. For example, I am thinking of this forty-year old woman who had considerable success in her life and who suddenly faced a demon from the past, in the most unexpected way. During one of the sessions, a hidden truth surfaced out of (seemingly) nowhere; she had been profoundly hurt by an event she experienced as a child—an 'emotional injury' she had hidden in order to protect herself so as to meet the demands of daily life –, but which nevertheless affected her actions and sentiments to this day. One way of reaching for this residual memory was to talk about it, and for her to relive the painful experience. She would then write about it once she went back home. This entire process has helped her to be at peace with this memory." (Claire Poulin, psychologist 2014).

10.8 One Question

The researcher can ask himself:

> Does my research respond to my initial problem? (even if it accepts *status quo*).

10.9 A Few Keywords

A few key words	
Discrimination	The art and science of making judicious choices to best select participants, observables, and questions in a questionnaire
Saturation	The art and science of knowing when to stop
Parallelism	The art and science of balancing words, phrases, and constructs by giving them equal weight and corresponding meaning
Rigor	Applying discrimination, saturation, and parallelism in the research based on data percolation
Validity	The researcher study is as error-free as possible in five respects:
	1. Convergent validity
	2. Nomological validity
	3. Internal validity
	4. Discriminant validity
	5. Instrument validity
Reliability	The study could be replicated and would produce the same or similar results (accounting for uncontrolled variables)
Exploratory	No firm conclusions reached
Confirmatory	General conclusions can be reached

10.10 A Few Tips

The researcher should:

- Give results and list the observations (in an objective way)[19] before discussing the results:

Example (observations made following the presentation of a model tested with structural equation modeling) (Fig. 10.1):

Predator position

Key measures: APC = 0.363, $p < 0.001$; ARS = 0.334, $p < 0.001$; AVIF 1.380, good fit if < 5.

Observation 1:…

Observation 2:…

Observation 3: Dependence plays a moderating role between perceived predation and trust, at least from a predator position point of view (*at* $\alpha < 0.05$) …[20]

[19] A large number of writings miss the opportunity to list observations before engaging in a discussion. Observations are there to help the reader (and the researcher) interpret the data in an objective way and to make the link with the inital problem that triggered the research. Only after listing the observations can the researcher engage in a discussion that entails some comparisons, judgments, and argumentation. Not before.

[20] Source: Mesly and Lévy Mangin (2013)

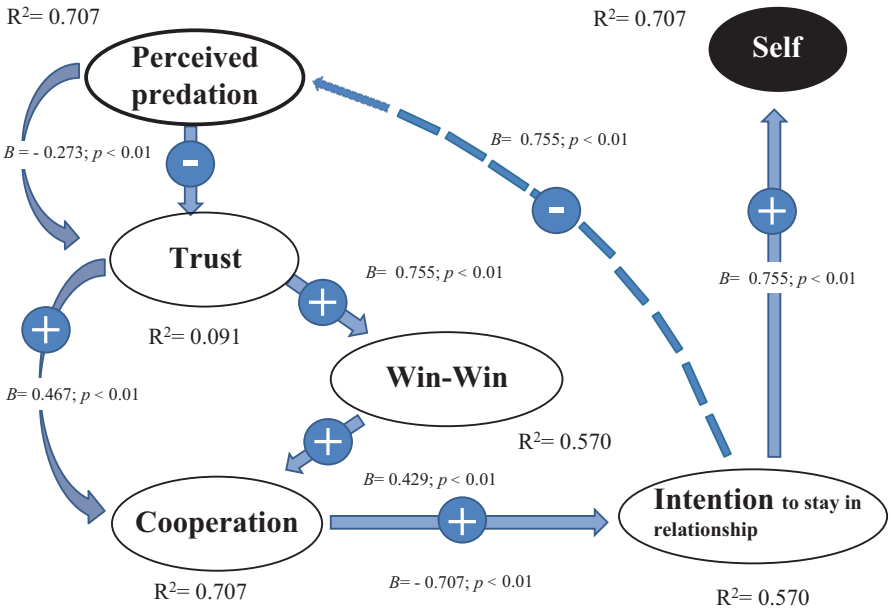

Fig. 10.1 Exploratory analysis with 1324 participants using PLS. *PLS* partial least squares

- As the researcher prepares for his defense:
  - Read what the jury has written or what reviewers have written.
  - Prepare answers in advance to possible questions the jury/reviewers may ask.
  - Film himself when doing rehearsals.
  - Reserve some extra slides that answer potential questions the jury might ask.

Appendix

This book concludes this essay on the data percolation methodology as a way of preparing the researcher to limit biases, to create models, to gather data, and to analyze clear and dark spots.

All these steps take a lot of practice, especially creating models[1]. It is through practice that the researcher can develop the judgment and intuition necessary to identify and define the right constructs and their observables. Research is a process without end, so the researcher cannot pretend to have discovered the ultimate truth, especially not in psychology.

Every discovery is a new beginning.

[1] Annex F provides a check list for the student at the doctoral level.

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SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5

Annex

Annex A
List of Keywords Related to Perceived Predation in Various Disciplines (Examples)

Communication
Communication; *two-way communication* (Anderson and Weitz 1989); *inhibition*; stand; ability to solve problems together; reciprocity; information gathering; consultation; listening skills; adaptability; ability to identify needs; dialectics; flexibility; ability to negotiate; self-monitoring; self-talk (Neck and Manz 1992)
Environment and symmetry
Vulnerability; partnership; relative dependence (Anderson and Narus 1990); complementary skills; stakes (Anderson and Weitz 1989); relational norms of exchange (Gundlach et al. 1995); closeness of relationship (Salerno 2001); climate; culture; atmosphere; reciprocity; attachment (Thomson et al. 2005); adaptation (Brennan et al. 2003); positive and negative reciprocity (Bolton and Ockenfels 2005)
Uncertainty
Open sharing of information
Equilibrium
Robust equilibrium (Bendor and Swistak 2001); reflective equilibrium[a]; punctuated equilibrium; sequential equilibrium (Kreps and Wilson 1982)
Dynamics
Process; extendedness (Heide and Miner 1992); cyclic; iterative process (Anderson and Narus 1990); client's value chain (Tzokas and Saren 2004); expected reciprocation (Anderson and Narus 1990); convergence; congruence (Gavard-Perret and Helme-Guizon 2003); synchronization; adequacy; harmonization; stakes; attachment (Thomson et al. 2005); commitment (Moorman et al. 1992); connection (Thomson et al. 2005); bargaining; interaction; cognitive links (Valette-Florence et al. 1993); compatibility (Roehrich 2001); feedback (Garbarino and Johnson 1999)
Threats and risks
Opportunism (Williamson 1981); retaliation; predation; risks; punishment; tit for tat (Molander 1985); politics; intimidation and innuendoes (Zanzi and O'Neil 2001); ostracism (Henrich et al. 2005)

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SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5

Predation
Economic predation (Thorstein Veblen[b]); symbolic violence (Pierre Bourdieu[c]); under-classes (Galbraith 1992); proletariat and class struggle (K. Marx)
Representation
Image, representation, stereotype, theme, diagram, script; impression; construct; profile; framing (De Carlo 2004), profile and mental shortcuts (Pantin-Sohier and Brée 2004); distortions (Holbrook and Huber 1979)
Competition
Cournot–Nash equilibrium (prisoner's dilemma); costs of transaction; benefits; economic performance; individualism; payoffs (profits); interest; gains and losses (tangible and intangible); rewards (tangible and intangible); range of products and services; economies of scale; risk sharing; convergence of individual skills; favors; economic and psychological spending; opportunity costs; disadvantages; socio-psychological costs (example: anxiety); aggravation (Morgan and Hunt 1994); loss of prestige; loss of autonomy; costs of learning; ambiguity of roles; uniqueness; conflicts; confrontation (Zhang et al. 2007); helpers and persuaders (Mallalieu and Nakamoto 2008)
Cooperation
Pareto efficiency; transactions; exchanges; trust; solidarity; benevolence; mutual giving (Grönroos 2004); pie expansion (Jap 1999); harmonious cooperation; collectivism; flexibility; reciprocity; idiosyncratic investments and contractual terms; alliance; social bonding; bilateral governance; integration, trust, commitment, solidarity (Joshi and Arnold 1997); coalition building (Zanzi and O'Neil 2001); networking; cooperative competition (Dagnino 2004); compromise (Zhang et al. 2007)
Value system
Noneconomic factors; psychological attachment; internalization (O'Reilly III and Chatman 1986); tangible and intangible factors; shared values (Morgan and Hunt 1994); centrality (McMullan and Gilmore 2003); image building (Zanzi and O'Neil 2001); experiential and non-experiential components (Aurier et al. 2004); instrumental and final values (Rokeach 1973); overall value (Aurier et al. 2004), nonverbal behavior; attractiveness; HCC: high cultural capital; BPI: brand personality inventory
Values
Value chain, consumer value, perceived value, added value; overall perceived value (Aurier et al. 2004); satisfaction; added value; evolution, super-ordinate goals (Zanzi and O'Neil 2001); inspirational appeals (Yukl and Falbe 1990)

[a] John Rawls: (1921–2002). American philosopher who wrote important works on political philosophy (Example: A Theory of Justice, 1971)

[b] Thorstein Veblen (1857–1929): American economist and sociologist

[c] Pierre Bourdieu (1930–2002): French sociologist who developed the concepts of habitus, symbolic violence, and the theory of social fields and locations

Annex B
Comparisons Between Qualitative and Quantitative Methods (Excerpts)

Qualitative[a]	Quantitative	Authors
Sensory	Sensory	Blaikie (1991, p. 120); Sobh and Perry (2006, p. 1195)
Interaction between researcher and participant	Researcher is independent	Creswell (1994, p. 5)
Reality is built through own conception	Assume a single reality	Blaikie (1991, p. 123)
Use of words	Use of numbers	Sobh and Perry (2006, p. 1194); Brannen (1992)
Process	Static	Bryman and Bell (2007, p. 650); Bryman (1988)
Targeted; small	Targeted; large	Lamoureux (1992, p. 49)
Small sampling	Large sampling	Sobh and Perry (2006, p. 1194); Brannen (1992)
Close to participant	Far from participant	Brannen (1992)
Using qualitative and quantitative methods jointly make it possible to…		*Authors*
Provide a variety of responses		Sobh and Perry (2006, p. 1202)
Find similar and contrasting results		Blaikie (1991, p. 123)
Identify patterns		Blaikie (1991, p. 123)
Reduce errors		Blaikie (1991, p. 123)
Cross-pollinate		Brewer and Hunter (1989, p. 13)
Generalize and go deeper		Hanson et al. (2005, p. 224)
Use the qualitative to guide the quantitative effort in 1) Structuring hypotheses 2) Creating measures 3) Analyzing data 4) Interpreting variables and bonds		Bryman (1988, pp. 134–135, 137)
Use the quantitative to guide the qualitative effort in 1) Selecting participants/groups 2) Interpreting contextual information		Bryman and Bell (2007, p. 648)

[a] See also Miles and Huberman (1984), Hammersley (1992), Guba and Lincoln (1994), Guibert and Jumel (1997), Hair et al. (1998), Pellemans (1999), Maxwell (1998), Patton (2002), Maxwell and Loomis (2003), Thiétart (2003), Johnson and Onwuegbuzie (2004), Creswell and Plano Clark (2007), Greene (2007), Bergman (Eds), (2008)

Annex C
Examples of Questions with Dubious Psychometric Value

In chronological order

Campbell et al. (1988), **Adler and Graham** (1989)
Problem-solving approach
Rate your own bargaining strategies on the following scales:
Solving a mutual problem
Exploitative 5,4,3,2,1 Accommodating
Honest 5,4,3,2,1 Deceptive
Informative 5,4,3,2,1 Persuasive **(same scale?)**
Unbiased 5,4,3,2,1 Biased
Interpersonal attraction
How interested would you be in seeing the person with whom you were paired again? **(complex sentence?)**
Interested 5,4,3,2,1 Uninterested **(same scale?)**
Heide and John (1992, p. 37)
7-point scale: completely inaccurate description/completely accurate description
Norm of flexibility
The parties expect to be able to make adjustments in the ongoing relationship to cope with changing circumstances. **(How to know what other people think?)**
When an unexpected situation arises, the parties would rather work out a new deal than hold each other to the original terms. **(Rather vague?)**
Norm of information
In this relationship, *it is expected* that any information that might help the other party will be provided to them. **(by whom?)**
It is expected that the parties will provide proprietary information if it can help the other party. **(Who is expecting this?)**
It is expected that we keep each other informed about events or changes that may affect the other party. **(Who is expecting this?)**
Norm of solidarity
Problems that arise in the course of this relationship are treated by the parties as joint rather than individual responsibilities. **(I get scared of being held responsible. I will modify my response consequently)**
The parties in this relationship do not mind owing each other favors (sic). **(What proof do I have that the parties do not mind?)**
Heide and Miner (1992, p. 287)
7-point scale: completely inaccurate description/completely accurate description
Flexibility
Changes in "fixed" items are not ruled out by the parties, if it is considered necessary(sic).**(Changes made by whom?)**
The parties feel it is important not to use proprietary information to the other party's disadvantage**. (Complex, negative sentence)**

A characteristic of this relationship is that either party is expected to make demands that might be damaging to the other. **(Vague?)**
The parties expect the more powerful party to restrain the use of his power in attempting to get his way. **(Vague?)**
Metcalf et al. (1992, p. 45)
(Items were adapted from the IMP study and scored on a five-point scale with end-points 1 = strongly disagree and 5 = strongly agree.)
Purchasing people/salespersons quickly respond to our requests for a call. **(How to measure quickly?)**
The buyer/seller is particularly interested in following up on how the seller's products are used. **(This is not an observable, it is a judgment.)**
(*Items were adapted from the IMP study and scored on a five-point scale with end-points 1 = strongly disagree and 5 = strongly agree.)*
Morgan and Hunt (1994, p. 35)
Communication
In our relationship, my major supplier… (anchors: strongly agree/strongly disagree)
…keeps us informed of new developments**. (Who is "us"?)**
… communicates well his expectations for our firm's performance
Opportunistic behavior
To accomplish his own objectives, sometimes my supplier… (anchors: strongly agree/strongly disagree)
…alters the facts slightly. **(How do you define "slightly" in the context?)**
…promises to do things without actually doing them later
Ganesan (1994, p. 15)
Long term orientationa between retailer and vendor as resources
We believe that over the long run our relationship with this resource will be profitable
Maintaining a long-term relationship with this resource is important to us
We focus on long-term goals in this relationship
We are willing to make sacrifices to help this resource from time to time
(Who is "we"? The questionnaire is not supposed to test what someone else thinks)
McAllister (1995, p. 40)
Performance measure
Overall, to what extent do you feel that this person is performing his/her total job the way you would like it to be performed**? ("total"?)**
If you had your way, to what extent would you change the manner in which this person is doing his/her job? **(This requires a qualitative response.)**
McAllister (1995, p. 37)
Affect-based trust
We have a sharing relationship. We can both freely share our ideas, feelings, and hopes. **(Two sentences, two ideas—to which to respond??)**
I can talk freely to this individual about difficulties I am having at work and know that she/he will want to listen. (**Two ideas—to which to respond??)**
We would both feel a sense of loss if one of us was transferred and we could no longer work together. **(Two ideas—to which to respond??)**

If I shared my problems with this person, I know (s)he would respond constructively and caringly (sic). **(The "if"—is this a simulation?)**
I would have to say that we have both made considerable emotional investments in our working relationship. **(What do we measure? The obligation "I would have to say"?)**

[a] A concept often used in marketing literature

Annex D
Cronbach's Alpha

Cronbach's Alpha at Sherbrooke Toyota[2]

Number of elements: 9

Cronsbach's alpha: 0.920

Cronbach's alpha with normalized elements: 0.925

The questions (codes G22, G 31, etc.) are all different from each other (are not additive). Example:

Flexibility (code G60):

G 61: she/he adapts to changes, unplanned events.
G 62: she/he finds ways to adapt to my constraints.
G 63: she/he shows initiative.

Exchange of information (G70):

G 71: she/he always keeps me informed.
G 72: she/he shares his knowledge with me.
G 73: she/he provides useful information.

Joint problem resolution (G80):

G 81: We share duties and responsibilities when necessary.
G 82: We make decisions together as if we were partners.
G 83: We discuss possible solutions together when facing difficulties.

Orientation (G90):

G 91: she/he has a keen interest in our relationship.
G 92: she/he wants our relationship to be beneficial for both of us.
G 93: she/he wants to maintain a long-term relationship with me.

[2] The research was done in French. The questions that are listed were in French and translated here for the purpose of showing the differences between each of them.

Annex E
Examples of Useful Sentences

"In an attempt to answer this question, we conducted follow-up interviews with a few of our respondents" (Ganesan et al. 2005, p. 56). (validation with participants)
"Also commonly found is the 'key informant' approach, where dyads with one subject on each level are taken into account […] obtaining data from multiple informants has been recommended as superior to such an approach" (Wieseke et al. 2008, p. 324)
"Following minor modifications to structure and wording, the instrument was pre-tested with a set of executive students similar to those ultimately targeted to participate in the research. The results suggested the instrument was understandable, interpreted appropriately, and captured the characteristics of marketing practice of interest in this investigation" (Coviello and Brodie 2001, p. 391)
"[…] even if it is true that people can fake most measures of self-report, there is no evidence at all that they actually do fake such instruments either in applied settings or in basic research in psychology […] There is a great deal of positive evidence to show that many measures of self-report are reasonably valid" (sic) (Nunnally 1970, p. 369)
"Consistent with the dyadic approach developed by Anderson and Weitz (1989), we used parallel wording for the retailer and sales manager reports" (Dahlstrom and Nygaard 1999, p. 164)
"Most experimental studies to date have used undergraduate or graduate business (MBA) students as subjects for reasons of (1) ready access to the subject pool, (2) convenience in recruiting on university campuses where most of the research is carried out, (3) low opportunity cost of student subjects, (4) relatively steep learning curve, and (5) some lack of exposure to confounding external information" (Friedman and Sunder 1994, p. 39)
"In the first phase, we obtained a customer list for each dealership from the dealer's parent organization. This list included the names of three customers per dealership. […] In the second phase, we mailed questionnaires to the 290 salespeople that customers in the first phase identified. To ensure we obtained matched dyads, we provided each salesperson with the name of the customer who identified him or her and asked the salesperson to respond to all questions with the specific customer in mind (we did not reveal customer responses)" (McFarland et al. 2006, pp. 108–109)
"Strictly speaking, one validates not a measuring instrument but rather some use to which the instrument is put. For example, a test used to select college freshmen must be valid for that purpose, but it would not necessarily be valid for other purposes" (Nunnally 1970, p. 133)
"To compare for method and artifacts and nonresponse bias, we compared all construct means and did not find significant differences between respondents of the two methods of survey administration or between early and later respondents" (sic) (Ahearne et al. 2010, p. 463)
"(1) All items have significant factor loadings; (2) None of the items have significant cross-loadings; (3) Cronbach alpha greater than 0.70; (4) Average variance extracted greater than 0.50: this suggests that all these constructs exhibited sound psychometric properties" (Ahearne et al. 2010, p. 462)
"The trust construct was initially measured by nine items that were derived from the extant literature" (Ferrer et al. 2010, p. 430)
"The method (personally administered questionnaire) was chosen because of its relevant advantages such as the ability to ask complex questions, to clarify the question, speed, motivation, anonymity, sample control, and quality control. The disadvantages of a personally administered survey were cost, the potential for interviewer's bias, and longer duration of data collection (Aaker et al. 2000) (sic)" (Kassim and Abdulla 2010, p. 361)

Annex F
Doctoral Student's Checklist

Did you?

Step	Description	Yes/no
Preparing		
1	Set up a communication pattern with your supervisor	
2	Keep a tally of: (1) words related to your key concepts, (2) key sentences you find in the literature, and (3) the percentage of different types of journals you read	
3	Keep a diary	
4	Self-assess your ideas and motivations	
5	Find a topic with individual and social impact	
6	Aim first for small samples, then enlarge it	
Work in an "emerging" fashion		
7	Create a draft model	
8	Accept inductive and intuitive inputs	
9	Define by the opposites	
10	Seek contrasting cases	
Reading		
11	Use the five sources of information:	
	Literature	
	Experts	
	Qualitative domain	
	Quantitative domain	
	Simulations (computer-generated)	
12	Discover significant observables	
13	Use data percolation techniques (e.g., participative summary)	
14	Minimize errors (e.g., in questionnaires, scale construction)	
15	Use the hypothetico-deductive method with caution	
Talk and write in a way that the participants can understand		
16	Improve your model (e.g., type of research, types of variables)	
17	Clearly identify and formulate your hypotheses	
18	Perform the nine steps of data percolation 1) Cross check data 2) Identify contrasting results 3) Identify emerging concepts 4) Identify patterns, trends or general laws 5) Seek hidden truths 6) Establish the minimal and maximal thresholds 7) Take a step back 8) Identify the indifference point 9) Ask yourself the six questions of data percolation	

Step	Description	Yes/no
19	Ask the six questions of data percolation 1) Have I obtained similar results with all the methods? 2) Have I obtained similar results with contrasting participants? 3) Are new concepts emerging out of the different results obtained from the various methods? 4) Does the information collected from one method help understanding the results of the other methods? 5) Do I obtain a "clearer, more accurate and nuanced view"? 6) Did I identify the indifference level of the participants?	
20	Complete your model	
21	Anchor your work in: 1) A context 2) A trend 3) A concept 4) A model 5) A methodology 6) Research	
22	Demonstrate rigor and linearity; list results and observations	
23	Pass the reality test and be able to defend yourself against attack	
24	Finish your master's or doctoral thesis	

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O. Mesly, *Creating Models in Psychological Research,*
SpringerBriefs in Psychology, DOI 10.1007/978-3-319-15753-5

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