

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

scientific papers go on with overly complex models that no one can use in real life¹. 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 theme²:

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 one³: 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.

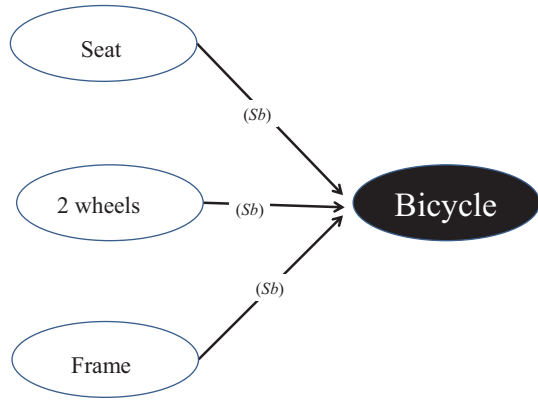
² Olivier and Payette (2010, p. 18) about modeling: group of concepts linked together by some sense of coherence and definition, giving a simplification of reality.

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 *bicycle* 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.

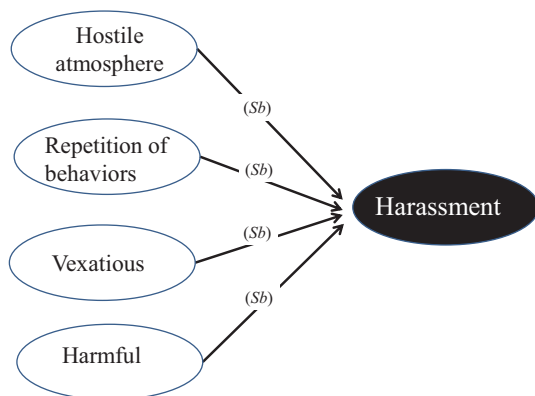
This can be put under a real life perspective involving a concept, that of harassment. Under the Quebec law, in order to prove harassment, there must be evidence of each of the following four elements (they are thus *structural* concepts) being present, as per Fig. 2.3:

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

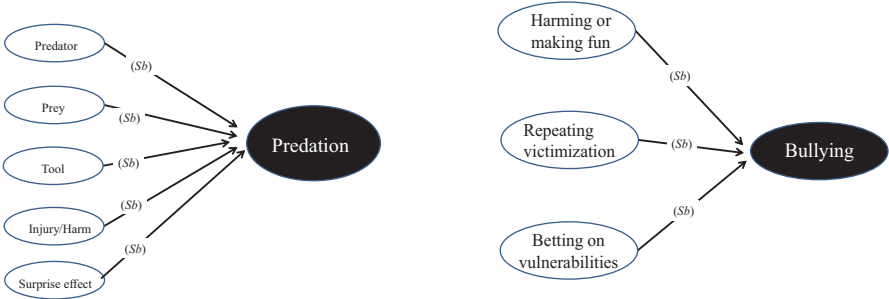


Fig. 2.4 Structural binary elements (Sb) forming the main construct of predation and bullying

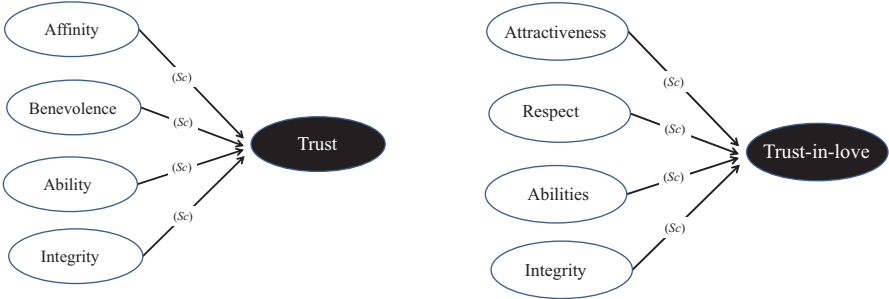


Fig. 2.5 Structural continuous elements (Sc) forming the constructs of trust and love

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 are⁶. 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 arrows⁷ (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.

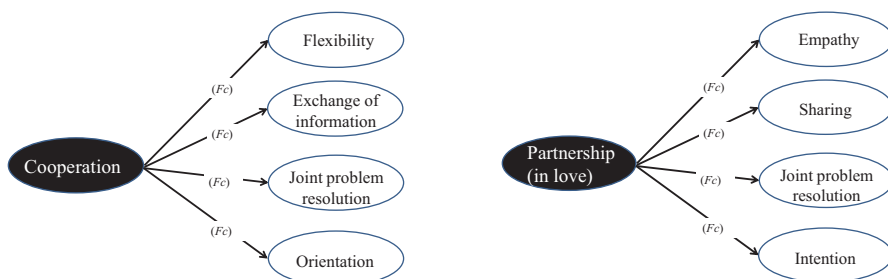
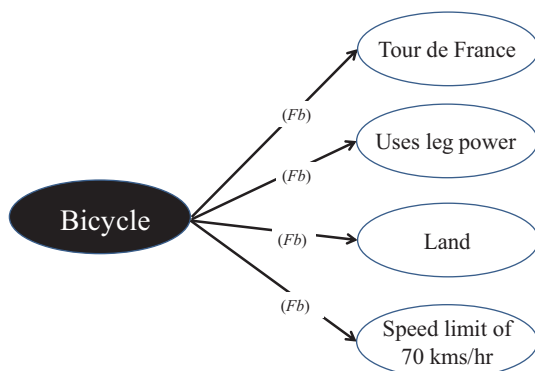
Let us use an example: cooperation—the capacity to work with others. Cooperation is an action, unlike trust, which is more like a sentiment. Actions can be seen. So the researcher does not define cooperation by its components (structural variables) but by its manifestations (*functional* variables, with 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 statistics⁸) and functional variables (akin to reflective variables). In par-

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

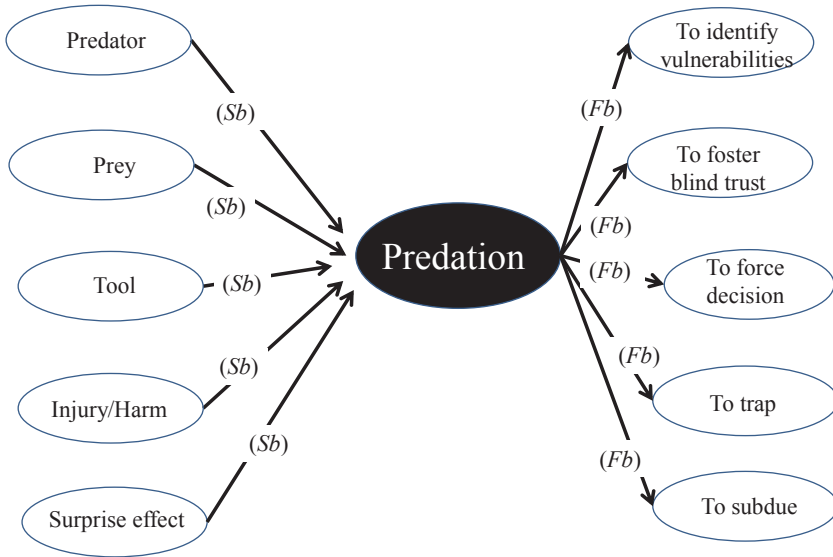


Fig. 2.8 Structural (*Sb*) and functional (*Fb*) arrows in the consolidated model of predation (CMP)

ticular, unlike structural variables⁹, 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 (<i>S</i>)	Doing a regression without independently measuring the main construct	Binary (<i>Sb</i>)
	Boosting Cronbach's alpha	Continuous (<i>Sc</i>)
		Temporary (<i>sb</i> or <i>sc</i>)
Functional (<i>F</i>)	Not recognizing high potential for colinearity	Binary (<i>Fb</i>) or continuous (<i>Fc</i>)

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 continuous¹⁰ 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):

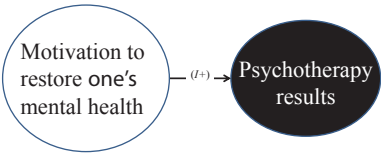
To define a construct fully, the researcher needs both sides of the equation: he must identify the structural *and* the functional variables.

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

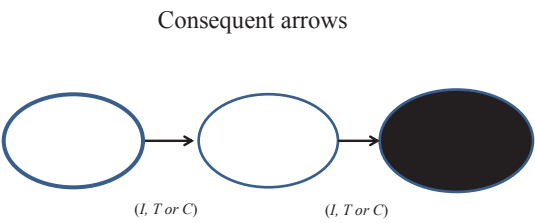
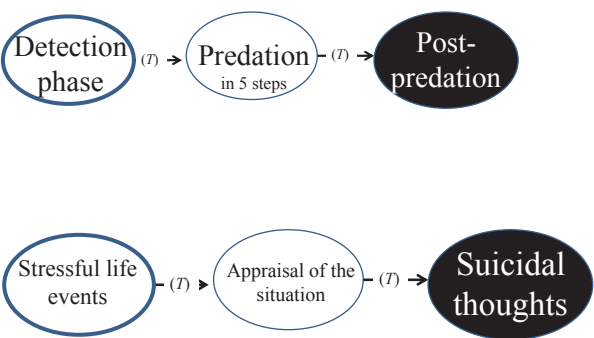


Fig. 2.11 A chain of bubbles



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.”

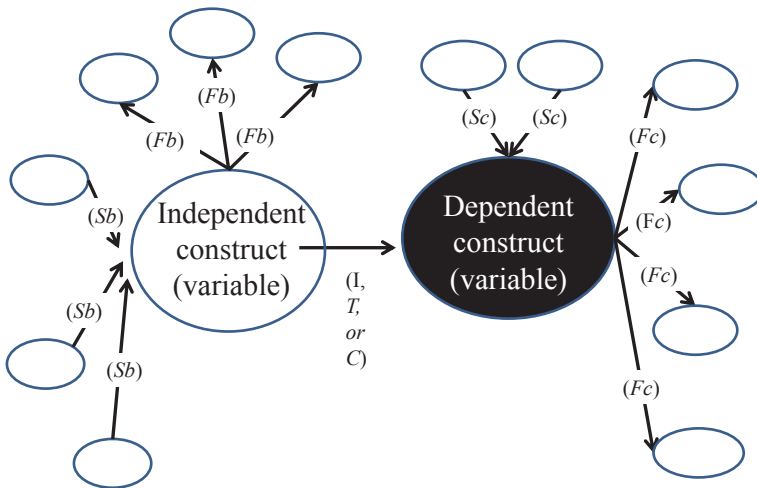


Fig. 2.13 A complex model in the making

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 (<i>S</i>), identified, even tentatively?
	How about the functional arrows/bubbles (<i>F</i>)?
	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 (<i>S</i>)—binary or continuous, or functional (<i>F</i>)—binary or continuous arrows. No time factor
Structural arrows	Structural arrow that expresses the fact that there is a <i>sine qua non</i> 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>I</i> , longitudinal— <i>T</i> , or causal— <i>C</i>)

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.

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