

## CHAPTER 5

### INFORMATION FLOWS AND THEIR CAUSES

#### Introduction

Imagine you want to buy a new car. Think of the types of information you might want in order to decide what model to buy. You'd be interested in the number of passengers and amount of baggage space, fuel consumption, the engine size and acceleration, handling and comfort, safety features, and the cost of servicing. You'd probably look at the price and any financing options to make sure you get the best value for money.

Now think where you'd get this information. You have many possible sources. You might browse through advertisements in magazines. You could visit car dealers and look at the vehicles for sale. You could ask the salesperson for information or pick up brochures on each model. You might talk to a friend who has just bought a new car. You could even ask your friend to let you test-drive it.

There are so many possible sources that you cannot pay equal attention to all. You must be selective. But why choose some and not others? What determines where you get the information? Or in technical terms, what factors determine the level of information flows to a receiver from various potential information sources?

You might read a magazine advertisement because it is attractive and easy to read. You might talk to a friend because you trust her judgement, or phone a salesperson because you think he has a lot of information. You visit the local car dealership rather than a larger one across town because it is closer and more convenient.

It is clear that many factors -- ease of use, credibility, expertise, proximity, to name a few -- can influence your information sources. This chapter proposes a list of these factors. I've collapsed them into the ten "HELP SCORES" characteristics proposed by Havelock (1969) and Havelock and Lingwood (1973): *Homophily, Empathy, Linkage, Proximity, Structure, Capacity, Openness, Reward, Energy and Synergy*. I propose that these characteristics can be used to predict the level of information flows from each source to a receiver.

#### Outline of this chapter

After defining some terms I use throughout the study, this chapter focuses on the key concept of "information flow." I then briefly discuss various approaches to research on information flows, concentrating on the following independent variables: characteristics of the topic, message, situation, time, receiver, and source. Finally, I propose that with suitable adaptation, the HELP SCORES variables can be used to predict information flows from various sources to a receiver.

## Concepts

### Information

Somewhat surprisingly, *information* is something of a primitive term (Reynolds 1971:46) in communication science. It often remains undefined or is stated in terms of other concepts that are equally difficult to nail down, such as "knowledge" and "communication."

Rogers (1983:6) defines information as "a difference in matter-energy that affects uncertainty in a situation where a choice exists among a set of alternatives." Rogers does not expand on what he means by the puzzling term, "a difference in matter-energy." And his focus on choices among a set of alternatives seems unnecessarily restrictive. We do not have to be in the situation of having a set of alternatives to obtain information; indeed, information may create alternatives where none existed before.

The definitions of Atkin (1973:207) and Wiio (1980:18) come somewhat closer to the mark. Wiio conceptualizes information as something that reduces uncertainty, while Atkin defines it as "something that the receiver does not already know." But both these definitions are also limiting: they fail to admit as information "redundant" messages that reinforce already existing cognitions or remind a receiver of knowledge already held. And Wiio's definition ignores that information may also increase uncertainty.

We can thus expand on Wiio by defining information as something that *affects* uncertainty about a topic. This subsumes both "new" messages that tell something that the receiver does not already know, and "old" messages that remind or reinforce.

### Information receivers

An information receiver is a person who obtains, or who may potentially obtain, information on a given topic.

### Information sources

Information sources are persons, institutions or channels identified by the information receiver (or an observer) as actually or potentially providing the receiver with information on a given topic.

Note that I'm using the word *source* to mean some combination of source and channel, to use the terms of Berlo's (1960) SMCR (Source-Message-Channel-Receiver) model. Rogers (1983:197) uses *channel* to refer to the same concept. I do not distinguish between a true source (such as "your boss"), a channel (such as "the telephone"), or a source/channel combination (such as "phone conversations with your boss"). With some combinations, the true source may be unknown, unidentifiable or irrelevant. The true source may be identical for several different source/channel combinations, as when a researcher disseminates the same information through a publication, a seminar, and a radio program.

The identity of the true source is further obscured because we often group individual source/channel combinations into categories or types. For instance, an extensionist may

draw on "research reports" for information. The term "research reports" is a category of many combinations of individual sources and channels -- numerous researchers (the true sources) writing in several different publication series published by different organizations. The extensionist may know which publication series she uses as a "source," but is unlikely to know, or care, who the original authors are. Indeed, in some instances the true source may not be important at all; rather, we may be interested in the channel, as in a comparison of information flows via newspapers, television, and radio.

Combinations of sources and channels can be operationally defined as broadly or as narrowly as convenient. For instance, one study (such as this one) could compare among broad categories of source/channel combinations, weighing sets of publications and interpersonal communication against each other. Another might focus on information from different sources flowing via a single channel, such as radio. And another could focus on flows from the same source via different media (print, interpersonal, broadcast, etc.). Such comparisons are valid as long as the source/channel combinations used are mutually exclusive.

Source/channel combinations can be personal (individuals or organizations) or non-personal (books, newspapers, television). Much of the communication literature refers to either one or other of these types. Most theories predicting the amount of information a person obtains from personal sources do not transfer readily to non-personal sources, and vice versa. In part this is a measurement problem: it is difficult to develop measures of information flow that apply equally well to both types (Chaffee and Mutz 1989). It is also due to differences in the nature of the sources: we can engage in two-way interaction with other people, but not with books or newspapers. Theories of interpersonal communication thus tend to be two-way in nature, while theories of media use tend to be one-way.

We are thus faced with a problem if we want to include both personal and non-personal sources in a study. We must develop measures that are comparable across diverse source types. And we are forced to ignore the obvious two-way nature of interpersonal communication. The benefit of doing so is that we can compare directly between personal and non-personal sources. We do so at the cost of losing the explanatory power of theories that take two-way communication into account.

## **Information flow**

### **Definition**

Information consists of stocks and flows. Each individual holds a stock of information in memory (in the form of knowledge). This stock is continually being added to by incoming information flows -- messages, perceptions, interpretations -- and reduced by memory loss. High levels of flow affect the receiver's uncertainty in a major way; low levels affect uncertainty less.

Information flow is the quantity of information relevant to a given topic that a receiver obtains from a particular source. This is the variable we wish to predict for different information sources.

### **One-way vs. two-way flows**

The SMCR model and other communication theories have been subjected to severe criticism for assuming that the receiver is passive and that information flows only one way, from source to a receiver (Dissanayake 1986:64). Subsequent approaches, such as Havelock's linkage model (Havelock 1986a:98, Havelock and Lingwood 1973:277), credit the audience with a more active role, while the coorientation model (McLeod and Chaffee 1973) removes the distinction between source and receiver altogether.

Readers hoping for a two-way approach in this study will be disappointed. An SMS's choice of sources seems unlikely to be related to the level of feedback to that source. There are several interrelated reasons for this:

- What I refer to as a *source* is in fact a *source/channel combination* (Rogers 1983:198; see also the discussion of sources above). The true sources are often unknown or irrelevant, and may be identical for several source/channel combinations. For example, a researcher's finding may reach an extensionist via numerous source/channel combinations -- direct contact, publications, training, etc.
- It is difficult to relate any one research-to-extension channel with a single feedback mechanism. Hussein's research and my own experience suggest that much of the "upward" flow from farmers to researchers follows a different set of channels from the downward: the little that does take place is more likely to be direct researcher-farmer contacts rather than via the extension system (Hussein 1986:409). Similarly for research-extension relationships: most extension-to-research contacts appear to be interpersonal, while research-to-extension flows tend to be through publications.
- Experience and research in the developing world indicates that two-way communication between researchers and extension personnel is minimal (see for example, Seegers and Kaimowitz 1990, Kaimowitz 1990:xi, Benor and Baxter 1984:94, Coulter 1983:52, Cernea, Coulter, and Russell 1985:3). This is true also in Indonesia (Hussein 1986, Padmanagara 1985:137), despite the importance of farming systems research within AARD and the recent emphasis on Research-Extension Linkages Project (see Chapter 4). The Indonesian system is predominantly top-down in its orientation, with centrally determined recommendations transmitted "down" through the extension service to farmers. While attempts are being made to institutionalize bottom-up flows, such efforts have received relatively little attention.
- Two-way flow models are most appropriate for interpersonal communications. But source/channel combinations include impersonal as well as personal contacts. A receiver may obtain information from a publication without ever providing feedback to the author or publisher. While direct researcher-extensionist contacts do occur, they are rare (Hussein 1986:422). On the other hand, we might expect print media to be especially important for Indonesian extension personnel, since the extensionists are geographically scattered, and research institutes have devoted most effort into disseminating their results via publications. It makes little sense in such circumstances to attempt to measure two-way information flows.

This does not mean that extension-to-research communication is unimportant; indeed, the strength-of-weak-ties hypothesis (Granovetter 1973) would indicate that such flows are of major importance. But such upward flows seem unlikely to affect directly which sources SMSs use. We can thus study top-down and bottom-up flows separately. This study looks at the former, thereby fitting into the "feed in" cell in Compton's (1984) matrix for guiding the analysis of agricultural knowledge systems.

Nor do I ignore the desirability of two-way information flows or have eschewed the notion of an active audience. On the contrary, the model I propose is based on the premise that receivers actively choose their information sources based on their perceptions of the nature of the sources. This study thus falls into the information-seeking rather than the control paradigm (Krippendorff 1987:194).

A top-down view of information flow normally assumes a passive audience. Rather, I see sources as providing an array of information, from which receivers can then choose (see Chapter 2). Such a view combines a one-way analysis with the notion of an active audience. One of the purposes of this study is to discover the reasons receivers choose one source rather than others.

### **Treatment in the literature**

Information flow is treated in four ways in the literature: it is measured in descriptive studies, and used as an independent, intervening or dependent variable.

1. It is frequently studied descriptively (not related to theory) in research on information sources. For instance, Hussein (1986:421-422) lists researcher-extension contacts but does not relate these to any other variable.
2. It is used as an independent variable in studies of attitude formation, persuasion and learning. Much of this work has been done in social psychology. A typical design is to present subjects with an item of information and test its effect on attitudes and behaviors.

Information flow has been studied in field settings by sociologists and development communicators; a typical design here is to distribute information to an audience (such as on a new agricultural technology) and then to measure knowledge gain and attitude and behavior change.

3. An example of information flow used as an intervening variable, is Rogers' (1969:102, 112-122) study of mass media exposure in five Colombian villages. He used villagers' exposure to the mass media, a measure of information flow, as an intervening variable between antecedent variables (literacy, education, cosmopolitaness, social status, and age), and consequent variables (empathy, innovativeness, political knowledge, achievement motivation, and aspirations).

Information flow has also been studied in artificial small-group situations with different network patterns (e.g., wheel, circle, chain [Rogers and Agarwala-Rogers 1976:120]). The independent variable in such studies is the pattern or the individual's

position in the network; the dependent variable is usually the efficiency of performing a task such as solving a puzzle, or the individual's satisfaction with her or his role. Information flow often is not measured in such studies.

4. As a dependent variable, information flow has been studied within the uses and gratifications, information seeking, diffusion, network analysis and knowledge utilization paradigms. These were briefly discussed in Chapter 2.

In this study, I am interested in information flows as a *dependent* variable. In other words, I wish to find what influences the level of information flows to receivers from various sources.

### **Unit of analysis**

Information flows can be seen as traits of a *unit* such as a person, organization, or society. They can also be seen as attributes of a *relationship* between two units, or dependent on a *situation*. Unitary, relational, and situational concepts can be used at any level, from macro to the individual.

Whether information flow is a unitary, relational, or situational attribute determines what factors can be used to predict it.

- If information flow is seen as a unitary characteristic of an individual, then other characteristics of the individual -- age, sex, and personality, for example -- must be used as predictors.
- Viewing it as a situational attribute means we must explain it in terms relating to that situation -- for instance, problem recognition, constraint recognition, and level of involvement (Grunig 1983:10).
- Viewing information flow as a relational attribute allows us to use other attributes of the relationship to explain it. Such attributes could include the source-to-receiver distance, the receiver's familiarity with the source, and the perceived credibility of the source.

Information flow as a unitary attribute At the societal level, we can see the numbers of phone calls or cinema seats in a country as a unitary attribute of that country (e.g., De Sola Pool et al.'s 1984 communication censuses of the United States and Japan). Similarly, the number of programs broadcast by a radio station is an attribute of that station.

At the micro level, we can view the total amount of information an individual receives on a topic as an attribute of that individual. Research at this level typically tries to discover which characteristics of the individual influence how much information the person obtains. Examples abound in the innovation diffusion and information seeking literature (Rogers 1983:241, Grunig 1983:8).

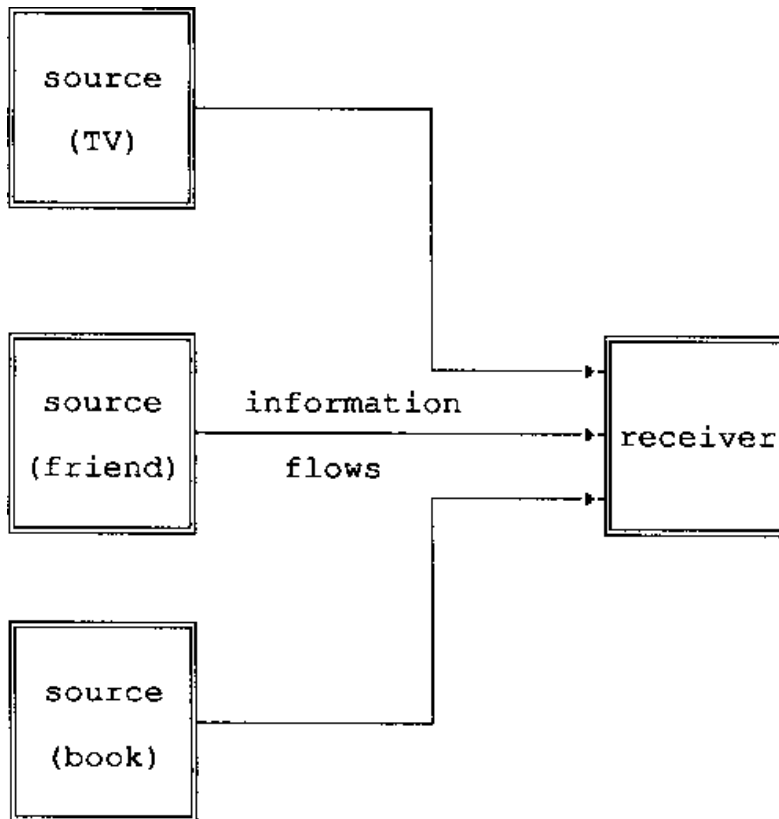
The total amount of information a person obtains and his information seeking method may well be unitary attributes -- dependent on the characteristics of the individual in question. But it is difficult to justify regarding information flows from numerous different

sources all as attributes of an individual. If we seek to discover why a person uses one source (say, research journals) rather than another (say, symposium proceedings), it makes little theoretical sense to attribute causation to characteristics of the receiver. It makes more sense to examine the relationship between each source and each receiver. Hence the relational view of information flows.

Information flow as a relational attribute The flow of information from a source to receiver is in some ways analogous to water flowing in an irrigation canal from a well to a field. Just as one field may be fed by many wells and canals, someone may get information from many sources -- books, other persons, the mass media, and so on. A single well can supply water to several fields; so too can each information source be a partner in many dyads with different receivers.

The total amount of water pumped from a well is a unitary attribute of that well. Likewise, the total amount received by a field is a unitary attribute of that field. But the amount flowing from each well to each field is an attribute of the relationship between the well and the field, since a separate figure is needed to describe the quantity of water for each pair of wells and fields.

Viewing information flows in an analogous way enables us to distinguish flows from each source to each receiver, rather than treating them as a whole. Instead of looking at the receiver or source alone, we can thus view them as a linked pair, or dyad. Information flow then becomes a characteristic of the dyad, or of the relationship between source and receiver (Figure 5.1).



**Figure 5.1** Information flows as characteristics of the relationship between a receiver and various sources

Relational variables can be measured at various levels, from dyads of societies and organizations to pairs of individuals. At the macro level, studies of international news flows and information exchange among firms may use a relational view. At the interpersonal level, we regard each pair of persons as a unit.

In this study, I was interested in the determinants of information flows to receivers from various sources. The sources could be individuals, classes of persons, or media types. A relational view of information flow, using individuals as receivers and categories of source/channel combinations as sources, would thus seem appropriate.

Information flow as a situational attribute An alternative is to view information flow as an attribute of the situation. To return to our irrigation example, this is analogous to arguing that the flow of water depends not only on the well (or the receiving field, or the relationship between them), but also on the time of year (dry vs. wet season), the weather, and intermittent pilferage of water by landowners along the canal. Such factors can raise or lower the water flow in the canal. They relate to the situation of the particular irrigation system and may change over time.

I chose to ignore the situational aspect of information flows in this study. I explain more fully later in this chapter.

### **Perspective**

Information flow in a dyad can be measured from three different perspectives: that of the source, the receiver, and an impartial observer. For instance, we could question a car salesperson (the source) about the amount of information she has given to a customer. Alternatively, we could question the customer on how much information he has obtained. Or we could observe a conversation between the two and rate it according to some objective scale, such as duration or number of topics discussed.

The level of flow measured is likely to depend on whose perspective is used. The amount of information provided by the source may actually differ from the amount received by the receiver -- as in a radio broadcast that no-one is listening to (De Sola Pool 1984:5-6). In addition, differences may also result from subjective perceptions: the salesperson may overestimate the amount of information she has given, while the customer may rate the amount lower. Both estimates may be different from that of the observer. All three may be colored by the different perceptions and memory of the actors.

Which is the most appropriate perspective for a study of research-extension linkages? Using each entails problems:

**Source** In a situation where much of the information flows through impersonal channels such as publications, a source (such as an agricultural researcher) may be unable to identify receivers or provide adequate estimates of the amount of information flow.

**Impartial observer** Using impartial measures such as numbers of publications received would seem to be ideal. But such measures suffer from two difficulties:

- Some types of information flow are relatively easy to measure. For instance, the numbers of publications sent or received can be seen in administrative records. But other types are more difficult to measure: oral conversation is an example. It is thus impractical for an observer to measure all types, since this would entail accompanying a subject at all times, noting the duration and topics of conversations and the types of publications read. Such an approach also is likely to interfere with the validity of the data collected.
- Someone can receive a publication but never read it, or can read it but not understand it. Directly observable measures cannot accurately reflect the amount of information actually reaching the receiver's brain.

**Receiver** Asking a receiver how much information she receives entails advantages and disadvantages. Advantages include that the receiver can (probably) identify the source and estimate the amount of information obtained from it. The receiver can also provide estimates of the amount of information flow on a common scale for different sources.

A disadvantage of questioning the receiver is that responses are biased by the

receiver's memory and perceptions. The receiver may have forgotten where she obtained an item of information, or how much she got from each source. And she may perceive the levels of flow from each source inaccurately.

Nevertheless, judicious questions may counteract some of the bias inherent in every receiver's perceptions. For instance, we can ask the respondent to estimate objective criteria such as the frequency of obtaining information from a source. We can also pose several questions to tap the same variable, thereby ensuring the reliability, if not the validity, of responses.

All in all, it seems that the receiver perspective is likely to yield more valid and usable data on information flows to extension personnel than would questioning sources or attempting to measure flows through an impartial observer. Accordingly, this is the approach I use in this study.

## **Summary**

The level of information flow from a source to a receiver is a characteristic of the dyadic relationship between the source and receiver. Sources can be personal or non-personal. Information flows are most appropriately measured from the perspective of the receiver.

## **Measuring information flows**

In order to measure information flows in a dyad, we must name the topic of the information flow, identify members of the dyad (the source and receiver), and gauge the quantity of information flowing between them.

## **Identifying topics**

Information is specific to a topic. Knowing the price of a car does not tell you anything about whether it will rain tomorrow. The two topics, "car prices" and "weather," are mutually exclusive. Other topics, such as "car safety features" and "car prices," may be related. Still others are nested within each other: "car prices" is a subset of the general topic of "cars."

Topics may be defined broadly or narrowly as a study requires. They must make sense to the respondent, and there must be a common understanding of what is meant by a topic among respondents to ensure that the data are valid.

Studies normally specify the topic in one of two ways:

- **Categories** (e.g., national political news, rice cultivation, cattle feeding). For instance, "What is your main source of national news?" Using topic categories has the advantage of universality: most respondents are likely to have received some information in a category. But such broad categories may not be specific enough if we want to know when or how someone obtained an item of information.
- **Facts** (e.g., the assassination of President Kennedy [Greenberg 1964]). Focusing on a fact allows us to discover when and how people get individual pieces of information. The fact must have the potential to reach a large proportion of respondents, and be salient enough for them to remember it. The Kennedy assassination is one such item. But highly salient facts may be communicated in a different way from more routine information. And it is difficult to identify salient facts of agricultural technology likely to be communicated or of use to all extensionists in Indonesia.

In this study, I was interested in the flow of a broad category of information on agricultural technology to extension specialists, as well as subcategories of this (such as information on cattle breeding and legume agronomy). Most of the questions therefore focused on categories. I also included a set of questions on specific facts as a validity check.

### **Identifying receivers**

Identifying sources and receivers is *not* necessary to study information flows per se; for instance, we can measure the volume of telephone traffic without knowing the origin or destination of calls. But identifying sources and receivers *is* necessary if we wish to measure or predict the level of flows in a particular dyadic link.

For this study, the population of receivers -- Indonesian agricultural extension specialists -- was known (though obtaining their names and addresses was a challenge, as described later).

### **Identifying sources**

A major problem lies in the wide variety of information sources. Different units are appropriate for each source. We cannot compare the number of publications a person receives with the number of hours he spends in conversation, since the two are measured on different scales. It is difficult to develop measures that can be used to compare information flows across sources (Chaffee and Mutz 1989). It is also difficult to conceptualize and explicate explanatory variables that apply to all types of sources.

Measuring information flows from the receiver's perspective (see above) can help overcome the problem of measuring flows from different sources. This is because we can ask the receiver to estimate the amount of information obtained from each source using a common scale. While this approach is far from satisfactory -- it may yield ordinal rather than interval level data, and is subject to the receiver's perceptual bias -- it seems preferable

to the alternatives.

The identity of sources can be seen as a "binary" measure (Monge and Contractor 1988:109): a particular receiver either has or does not have a link with each potential source for information on a particular topic. Note that this does not measure the strength of a linkage. Binary measures are often used to identify communication partners, and are then followed by questions of frequency of communication or the linkage strength (Rogers and Kincaid 1981:99).

Various methods are used to identify the existence of such links:

- The sources named by the respondent without prompting, as in, "Where do you get information on X?" or "With whom do you usually talk about [topic X]?" (Rogers and Kincaid 1981:97). The researcher may limit the number of sources to be identified, as in, "Please list the four faculty you use most as sources of extension information" (Mundy 1989:211), or "Who are the three other women in this village with whom you have discussed family planning?" (Rogers and Kincaid 1981:98). This method is used to identify the most-used sources of information on the topic.
- A roster, in which the respondent is presented with a list of all other members of the system and is asked whether he or she talks with each of them (Rogers and Kincaid 1981:98-99). This method can help identify possible "weak ties" -- infrequent yet important links between closely-knit cliques. It is also used in questions such as, "Did you watch the national TV news last night?" A disadvantage is that it is confined to systems where the number of possible sources is manageable enough to fit on a roster, such as in small neighborhoods or organizational departments.
- The sources of facts held by the respondent ("Where did you find out about X?"). This method too may identify weak ties, since people often find out new information from sources with whom they do not often talk (Granovetter 1973).

### **Measuring flow levels**

Binary measures are often used to identify communication partners, and are then followed by questions of frequency of communication or the strength of linkages in order to measure information flow levels (Rogers and Kincaid 1981:99).

The level of flows can be measured in a number of different ways:

- The ranking of information sources according to criteria such as importance, frequency of interaction, quantity of information obtained, etc. An example of such a question is, "Rank [the members of your system] in order of the frequency with which you talk to them" (Rogers and Kincaid 1981:102). Such measures are relatively easy for respondents to generate because they involve comparisons among sources. But they have two disadvantages: (a) they generate only ordinal-level data and (b) they assume that sources compete with (rather than supplement) each other. This is despite the frequent finding that people vary in the amounts of information they seek and obtain: e.g., an avid viewer of television news may also get a lot of information from newspapers or friends. Ranking obscures this.
- The frequency of exposure or attention the respondent devotes to a source, such as the frequency of meetings or informal contacts or attendance to the mass media. Questions measuring frequency include, "How often do you talk with B?" (Monge and Contractor 1988:109) and "How many times, in an average 5-day, Monday-to-Friday week, do you watch the evening network television news?" (Palmgreen and Rayburn 1982:570).
- The duration of exposure or attention the respondent devotes to a source. Questions include, "The last time you talked with this person, how long did your conversation last?" (Monge and Contractor 1988:109) and "How much time, in hours, did you spend with [each member of your system] this month?" (Rogers and Kincaid 1981:102). Other frequent questions measure the number of hours spent watching the television, reading newspapers, and so forth.
- The perceived quantity of information on the topic derived from the source, as reported by the respondent. A typical question is, "How much information on X do you get from B?" The researcher provides the respondent with a suitable scale (e.g., 5 = very much, 1 = very little). A related question, "How important is B to you as a source of information on X?" could be interpreted as a measure of the *relevance* of information from B (therefore a determinant of information flow, see below) rather than an indicator of information flow itself.
- The availability of information in the form of publications, telephones, television, etc. For instance, "Do you receive [publication X]?" and "How often do you receive it?"
- The number of words. This measure was developed as the unit for a "communication census" of Japan and the United States (Takasaki and Ozawa 1983, De Sola Pool et al. 1984:3). The census compared a wide variety of mediated communication methods, including television, books, newspapers, classroom teaching, telephone conversations and data communication. For most media, it is a measure of the time spent receiving information multiplied by an estimate of the number of words received per time unit. The number of words has two major disadvantages as a measure of information flows: it is difficult to measure flows in interpersonal channels, and it takes no account of meaning. The second disadvantage is the more serious: using the number of words criterion, a thousand words of gibberish is equivalent to the same number of carefully weighed and well understood words.

- The respondent's ability to recall topics covered by the source. This is often used in studies of television news, as in, "Can you name any of the topics in yesterday's evening news?" The number of topics correctly named is used as a measure of information flow.
- The respondent's learning of information provided by the source. Respondents are questioned about details of a topic communicated by a source; the number of correct responses is taken to measure information flow.

Receivers vary in the total amount of information they obtain. In order to distinguish low from high information recipients, we should therefore develop absolute, rather than relative, measures of information flows. This means we should avoid rankings as an information flow indicator. An index composed of several absolute measures, such as availability, frequency, duration and perceived quantity of information from the source would seem to be the best indicator.

A second problem is the need to identify "weak ties" (Granovetter 1973). Such ties are likely to be important for people in obtaining new information, but are difficult to detect using measures of frequency or volume. Using the roster method for identifying sources is one way of overcoming this difficulty. Another is to question respondents about where they obtained specific facts. This problem also implies a need for in-depth interviews of a small number of respondents in addition to a survey of a larger number. Interviews offer the flexibility needed to probe deeply into information gathering behavior -- a flexibility surveys do not provide. At the same time, a survey can provide a large quantity of uniform data in a form more tractable for statistical analysis.

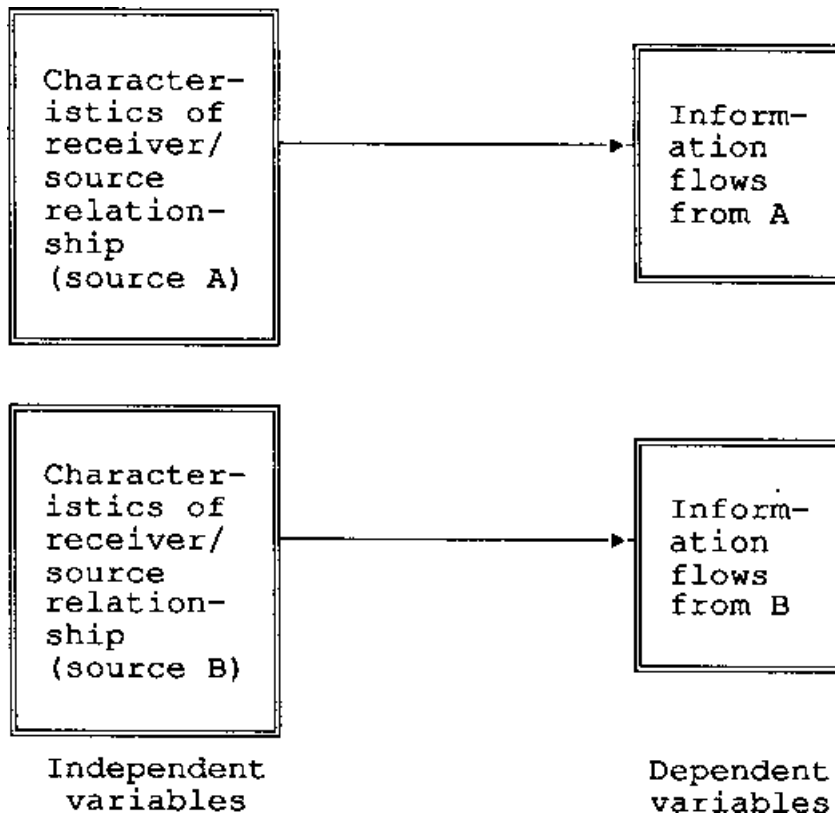
## **Summary**

In order to measure information flows, we must specify the topic and the source and receiver in the dyad. We can then gauge the level of information flow by questioning receivers. An interval scale should be used to ensure that total levels of information flow are comparable across respondents.

## **Influences on information flows**

Many factors can affect information flows. As it is not practical to study all these factors at the same time, it is necessary to control for some by holding them constant (or assuming they vary randomly with respect to another sources of variation).

Dependent and independent variables must be measured at the same unit of analysis to allow statistical tests of the relationships between them. If we view information flow as a relational attribute of the source-receiver dyad, we must seek influences on it that are relational also. We must explain it using other dyadic characteristics rather than with attributes of (say) the source or receiver alone (Figure 5.2).



**Figure 5.2** Information flows viewed as dependent on other relationships between a receiver and a source.

This section discusses six influences on information flow. It describes how aspects of these influences can be regarded as attributes of the source-receiver dyad, and thus used as predictors of information flow. I then propose hypotheses to test the relationship between the predictors and information flow as the dependent variable.

### How may information flows vary?

Naming ways in which a variable may vary can help us identify factors that may influence it. Information flows may vary in a wide variety of ways. They include:

1. Across topics. You obtain more information if you want to buy a car than if you're purchasing toothpaste.
2. Across messages. You pay attention to a glossy display ad for a car in a magazine, but not to a classified ad for the same model in the same magazine.

3. Across situations. If you are a first-time car buyer, you'll probably use different sources and get different amounts of information from the next time you buy.
4. Across time. As you near the decision to purchase the car, you probably seek larger amounts of information than when you first began to think about buying.
5. Across receivers. Even if both you and your friend are interested in buying a new car, you will probably not obtain the same amount of information or rely on the same sources.
6. Across sources. You do not obtain the same amount of information from a magazine advertisement as from a car salesperson.

Each of these is discussed below.

### **Topic**

Information flows vary according to the topic. We seek more information about a major purchase such as a car than about a minor one such as toothpaste. We may attend to local news rather than sports, scan the marriage announcements in the newspaper but not the births and deaths, and seek information on cars rather than computers.

The topic also affects the source we use (Midgley 1983, Maguire and Kench 1984). For instance, we are not likely to learn anything about the weather from a magazine advertisement about cars. We use newspapers to get international news, conversation to inquire after the health of a neighbor's children, and memos from the boss to learn of administrative decisions. Midgley (1983) found that men shopping for a social product (a suit) were more likely to seek information through interpersonal than through objective or impersonal sources. Deacon and Firebaugh (1988) show that the type of product (car, jewelry, vacations, etc.) determines which family member or members seek information on the product and makes the decision to purchase. Similarly, Shaninger and Sciglimpaglia (1981) found that both product characteristics and personality influenced housewives' search for information on durable and nondurable goods.

Extension specialists vary in their subject matter specialties: agronomy, pests and diseases, livestock husbandry, veterinary medicine, for example. Questioning them about their information sources on a single topic, such as rice agronomy, would be fruitless because most have no interest in this subject.

We can control for topic by asking extensionist respondents about agricultural information in general, or about their own particular specialties. The latter controls for topic by providing data about each respondent's professional specialization.

## Message

Journalists and advertisers are well aware that the form and content of messages influence the level of information flow. Communication students are taught to write for different audiences, design publications for easy reading, and compose attractive advertisements.

Sources become known for supplying messages with certain characteristics. For instance, a receiver may perceive a source as providing messages that are highly relevant, credible, and easy to use. Over time, these characteristics become associated with the source. Sources viewed as positive should therefore generate greater information flows to the receiver than other sources.

## Situation

If you already own a car, you have some experience. You will obtain a different quantity of information and use different sources from when you bought your first car. If you've just written off your car in a crash, you'll probably be looking for a new one more urgently than otherwise. And you may be receptive to information you might ordinarily ignore -- such as a magazine ad touting a model's safety features.

These are examples of how situations can influence information flows. You do not seek information on a topic or choose a particular source because of any characteristic of yourself or the source, but rather because of the situation you are in.

Various types of situations have been shown to affect information seeking behavior: the need for political information (Woelfel 1977); the patient's (rather than the doctor's) description of the health situation (Dervin 1980) and the "situation movement state" (Atwood and Dervin 1982, Atwood et al. 1982). Situation often has been found to interact with receiver characteristics in predicting sources sought (Atwood and Dervin 1982).

Receivers may actively seek information (*information search*), obtain it through routine scanning of messages (*information receptivity*), or acquire it because avoiding it is too much trouble (*information yielding*) (Atkin 1973:238). Grunig (1983:10-13) proposes that for people to become active seekers, they must recognize a problem in a situation that concerns them. Thus, if your car has fallen apart, you perceive a problem (the car is broken) and that you are connected with the problem (it's your car). You will thus seek information on alternatives, such as the characteristics and prices of new cars.

In this study I make no distinction between information search, receptivity and yielding since I am interested not in *how* someone obtains information, but in the *total quantity* obtained. In general, however, we might expect extension specialists to be active seekers of information on their subject area, since they presumably recognize the problems local farmers face and accept that they are connected with the problems (since it is their job to help farmers). My own experience in Indonesia indicates that the extensionists' search is highly constrained by the availability of time, funding and transportation. The distinction

between search and receptivity thus becomes moot.

Situations vary among receivers. For instance, a prospective car buyer in the United States faces a different set of situations from one in Indonesia. We can control for this variation to some extent by selecting respondents from a restricted group, such as people in similar occupations, thereby restricting the range of possible situations they may experience. Indonesian extension specialists perform generally similar tasks, have similar levels of education and experience, encounter similar problems, and have a similar set of possible information sources. While differences inevitably occur, these similarities mean that we can think of these extension specialists as facing broadly similar situations.

Grunig (1983:8) argues that situational theories of communication have received more consistent support in the literature than have cross-situational theories (i.e., those that view information flow as unitary or relational). While his arguments have considerable merit and are in line with current trends in social psychological thinking, I choose here to use a cross-situational approach, viewing information flow as an attribute of the source-receiver relationship.

This perhaps requires some justification.

- Grunig's (1983:19) situational variables were (1) whether the respondent thought about the topic (problem recognition); (2) how involved the respondent felt to be in the topic (level of involvement); and (3) whether the respondent felt he/she could affect the topic (constraint recognition). My respondent group, extension specialists, should respond affirmatively to all these points, making them members of the "active public" (Grunig 1983:10-13). I would therefore expect little variance on the situational dimensions Grunig outlines (though I did not test this assumption).
- When large numbers of respondents are randomly sampled, differences in their situations should be randomly distributed among subgroups. They should therefore balance out through the law of large numbers. Failure to take situation into account should increase the error term in statistical analysis, making any significant findings all the more credible.

## **Time**

Situations may vary in relatively predictable patterns over time. For instance, Rubin (1979) found that the types of information sought in interpersonal relationships change as the relationships mature. And diffusion research indicates that people seek different amounts of information about innovations through different channels and from different sources as they progress through the stages of innovation adoption (Rogers 1983).

However, information awareness may really depend on what channel has the information. As they move toward evaluation, people begin seeking information from *any* available source. In a study of the adoption of computers by farmers, both mass media and interpersonal source use peaked when respondents were in the evaluation/adoption stages (Abbott 1990). The important factors are thus source availability and the receiver's

adoption stage.

The effect of time on information flows is best measured through a longitudinal study. Doing so is difficult in a single cross-sectional design. I choose to ignore the time element here, assuming that variations in information flows will tend to cancel out when questioning a large sample of respondents about a broad topic.

## Receiver

Different people obtain different amounts of information, from different sources. Much of the research on information seeking has focused on the psychological and demographic characteristics of individual receivers. Because of their psychological makeup, social relations and experiences, people are seen as having different information seeking styles and obtaining different amounts of information. "Loners," for instance, obtain relatively little information about a topic before making a decision; "formal seekers" obtain information about a wide variety of options before committing themselves, while "risky seekers" obtain a lot of information about a narrow range of options (Donohew, Tipton, and Haney 1980).

A whole slew of individual characteristics has been associated with information seeking behavior. A short list includes: prior knowledge, egotism and sensation seeking (Donohew, Tipton and Haney 1980), nationality, socio-economic status, parental socio-economic status, educational attainment, childhood magazine use, need for activation, race, age, tolerance for ambiguity, self esteem, cognitive style, trait anxiety, dogmatism, and home ownership (Atwood and Dervin 1982, Capon and Burke 1980, Donohew, Palmgreen and Duncan 1980, Flinn and Jamias 1984, Hirshchmann 1981, Lambert and Durand 1977, Schaninger and Sciglimpaglia 1981).

But theories based on receiver characteristics have inconsistent results (Grunig 1983:8), and they fail to satisfactorily explain *why* people prefer one source over another. It is difficult to imagine why someone should use, say, television rather than books because of such personal characteristics as age, gender, or psychological makeup. It makes considerably more intuitive (and theoretical) sense to say she does so because she *likes* TV more than books, she thinks the TV is *easier to understand*, the TV is physically *closer*, and so forth. All these are relational characteristics because they describe the relationship a receiver has with a source, and they may vary among sources and receivers.

In this study, I examine the effects on information flows of some receiver characteristics, such as age, gender, and industriousness. Other receiver characteristics, such as psychological makeup, are difficult to measure using a mailed survey, the only practical large-sample data collection method available. I assume that such characteristics vary randomly with respect to information flows and the explanatory variables. Other receiver characteristics can be subsumed under measures of the relationship between receiver and source.

## Source

Sources affect information flow. We get more news from the television than from newspapers. Farmers in the United States rely heavily on the agricultural press for information on new technologies (Fett and Mundy 1990:6). We prefer to talk to our friends rather than our enemies.

Different sources supply larger or smaller amounts of information. A large publishing house produces more books than a small one; a 24-hour news television station puts more news on the air than an entertainment network. Such attributes do not vary from receiver to receiver, and can be measured relatively objectively -- as in number of minutes' news coverage aired, or the volume of publications produced.

Other things being equal, we might therefore expect information flows to be higher from a prolific source than from a less prolific one. Because of their larger size and greater funding, Indonesia's food crops research institutes have been more prolific (as measured by numbers of research publications) than the livestock institutes. We would therefore expect that food crops extensionists to recognize a larger total information flow from research than would their livestock colleagues (Hypothesis 1). I expand further on this topic in the section below on Capacity.

### Source-receiver relationships

Other characteristics that at first sight appear to be attributes of sources in fact vary from receiver to receiver. Such variation may be real or perceptual. For instance, receivers vary in their proximity to any one source. One receiver may view a source as exceptionally relevant, credible, and easy to use; another may think the opposite of the same source. And the specific sources that receivers refer to may be different: "your boss" refers to a different person for each receiver.

These characteristics can be seen as features of the relationship between receiver and source -- a formulation that eases their use as predictors of information flows -- for two reasons. They may depend on the receiver's *perception* of the source, and thus be subjective in nature. The source's credibility is one such attribute. Or they can vary among receivers according to *objective* criteria. The source's proximity to the receiver is an example.

The remainder of this chapter develops a model for predicting information flows

#### **Hypothesis 1: Prolificacy**

A1: Sources vary in the amount of information they provide.

A2: *Ceteris paribus*, the amount of information a source provides is proportional to the amount a receiver obtains.

TF: Receivers will receive more information from a prolific source than from a less prolific one.

based on Havelock and Lingwood's (1973:294) HELP SCORES model. I propose eight characteristics of the source-receiver relationship that affect the level of information flows from a source to a receiver. The eight factors are: Familiarity, Proximity, Structure, Capacity, Openness, Reward, Energy and Synergy. I have omitted Havelock and Lingwood's first two concepts (Homophily and Empathy) because they are difficult to apply to non-personal as well as personal sources, and have changed the Linkage concept to Familiarity for reasons explained below. I adapt the remaining seven factors to fit both personal and non-personal sources.

Adapting Havelock and Lingwood's original concepts is necessary because they relate to situations where the source is personal -- an individual or an organization. In such situations, both the source and receiver can be active in the communication process: two-way interaction can take place (Linkage), both source and receiver can be ready to give and receive information (Openness), and both can expend effort at exchanging information (Energy). Where non-personal sources (in reality, source/channel combinations) are involved, as in this study, it makes little sense to talk of two-way interactions (see the discussion of sources earlier in this chapter).

A second problem associated with Havelock and Lingwood's model is that the HELP SCORES concepts are not unidimensional or mutually exclusive. As Havelock himself points out (1969:11/20), they include:

"a host of variables which are distinct and which could have been listed separately. At the same time, the headings chosen are not discrete; there is much overlap, and some categories may be seen as subcategories of others."

Nevertheless, the HELP SCORES list is a useful starting point for a study of the determinants of information flows. Below I present a set of theoretical propositions that link the HELP SCORES concepts with information flow. For each of the characteristics, I present below theoretical propositions based on an axiom system. In doing so, I draw on the preceding discussion of influences on information flows. For clarity, I capitalize the concepts thus: Proximity.

### **Homophily and Empathy**

Havelock and Lingwood envisaged the HELP SCORES variables as describing characteristics of the relationships between receivers and *personal* sources, where both receivers and sources are individuals or groups (such as organizations). Extending their model to non-personal sources entails difficulties.

There is considerable evidence for the importance of Homophily and Empathy as influences on information flows (see for example, Rogers and Shoemaker 1971, Rogers 1983, Rogers and Kincaid 1981:133, Maguire and Kench 1984). Chapter 2 listed several aspects of both as problems in research-extension ties: the status differences between scientists and extension personnel, different motivations and personal orientations, different educational levels, and so forth.

But these characteristics seem to apply only to linkages where the source is an

### **Hypothesis 2: Familiarity**

A1: There must be a connection between a source and a receiver for information to flow between them.

A2: People prefer the familiar to the unfamiliar.

A3: Familiarity with an information source means a person knows how to obtain information from it easily.

TF: Information flow will be greatest from sources familiar to the receiver.

identifiable person known to the receiver. I use the term "source" to mean a source/channel combination (see the discussion earlier in this chapter). But Homophily and Empathy are difficult to apply to non-personal "sources" such as books and newspapers: you cannot be homophilous or empathic with a book. With the book's author, perhaps -- but the author is often unknown both to the receiver and to an outside observer. This problem is compounded when individual sources are taken as a group (e.g., "books" in general, rather than an individual title with an identifiable author whose characteristics can be determined). This makes the measurement of Homophily and Empathy at best impractical, and at worst meaningless.

Thus, while there is considerable evidence pointing to the importance of Homophily and Empathy in determining information flows, I am forced to drop these concepts from consideration here.

### **Linkage/Familiarity**

Linkage is seen by Havelock (1969:11/21) as signifying "the degree of interpersonal or intergroup connection; the extent to which mutual communicative relations exist between two or more parties." Note that this use of the term is different from the linkage model he subsequently proposed (see Havelock 1969:11/21 and the discussion earlier in this chapter).

In a study using interviews with managers in the U.S. Department of Labor, Havelock and Lingwood (1973:275) operationalized Linkage as any comment by the interviewee that indicated a "contact or relationship between persons or groups is sought or achieved." Linkages between individuals are often informal (e.g., Czepiel 1974, Eponou 1990, Mundy 1989:94, Rogers 1983:293).

Havelock and Lingwood (1973:299, 307) maintain that Linkage is the most important of the ten HELP SCORES factors in determining information flows. My research in Iowa (Mundy 1989:182) found that it was a significant but not the major influence on flows between researchers and extension personnel. However, in this study I had interpreted Linkage as being *social* relationships (Mundy 1989:27).

Interpreting Linkage as "the degree of interpersonal or intergroup connection" and "mutual communicative relations," or as the existence of social relationships is clearly not valid for non-personal sources. As a substitute for the purposes of this study, I replace the Linkage concept with the receiver's *Familiarity* with a source.

This requires some justification, especially since Havelock includes familiarity under the fourth HELP SCORES factor, Proximity. Havelock's concept of Linkage appears to measure the strength of the relationship between a source and a receiver. Frequent contacts indicate high Linkage; lack of contact reflects low Linkage. For non-personal sources, familiarity would appear a reasonable substitute for Linkage. Frequent or prolonged contact with books or newspapers makes us familiar with them. The same is true of personal sources such as individuals or organizations. I discuss the distinction between Proximity and familiarity in the next section.

Some degree of Familiarity is a necessary but not sufficient condition for information flows to occur. It may refer to whether the receiver knows of a potential information source, such as a publication or a colleague. People rarely seek information from sources they do not already know of. For instance, they are more likely to ask a colleague or reach for a book in their personal library than they are to write a letter to an unknown researcher or perform a literature search for the required information (Kelly and Wolek, quoted in Busch and Lacey 1983:88).

But this is not a binary, yes/no concept. Relationships vary in the strength, as reflected in the possible range of responses to the questions, "How well do you know [person B]?" and "How familiar are you with [source C]?" Answers to such questions can range from "not at all" (no Familiarity) to "very well" (high Familiarity).

The mere exposure effect proposes that people prefer objects they come into contact with frequently (Worchel, Cooper, and Goethals 1988:351). It would also seem likely that they will know how to obtain information from a source they are familiar with. From this it follows that Familiar sources should provide the most information (Hypothesis 2).

### **Proximity**

Proximity refers to the physical distance or accessibility of a source. Numerous studies have shown that propinquity breeds attraction and communication (Allen and Fustfeld 1975, Maguire and Kench 1984, Rogers 1983, Rogers and Kincaid 1981:133), though the precise mechanism for this remains under debate.

Proximate sources are likely to be more convenient to use than are those farther away. While he does not classify sources in terms of distance, Rosenberg's (1967:122) findings suggest that professionals use nearby rather than distant sources. Other mechanisms include propinquity leading to rewards, expectations of future interactions, and familiarity or "mere exposure" (Worchel, Cooper and Goethals 1988:348).

Whichever is correct, all explanations lead us to expect people to obtain more information from nearby or easily accessible sources than from those farther away

(Hypothesis 3).

That Proximity is not necessarily important is shown by Gidley's (1977) and my own (Mundy 1987) findings that distance was not an important determinant of information flows between extension personnel and researchers. However, both of these studies were conducted in developed countries (Australia and the United States), where abundant telephones presumably dilute the effect of Proximity.

Havelock's inclusion of familiarity as part of Proximity is based on analogy (Havelock 1969:11/27, emphasis added):

"[U]sers who have close proximity to resources are more likely to use them. Anything which is 'handy,' i.e., easily accessible, is more likely to be used. This generalization applies to people and things but also, *at least by analogy, to thinking processes (familiarity, recency, similarity).*"

However, physical distance and familiarity are conceptually distinct, and may be unrelated empirically -- though one may lead to another, as Havelock later points out. It seems better, therefore, to reserve Proximity for the concept of physical distance and accessibility, and to use Familiarity as a substitute for Linkage.

## Structure

Structure is conceptualized by Havelock (1969:11/23) as the "degree of systematic organization and coordination of elements." Evidence of positive structuring is operationalized by Havelock and Lingwood (1973:297) as "any evidence or [*sic*] planning, ordering, systematic arranging, scheduling, mapping in a framework, quantitative analysis or evaluation of objectives, work or output," while lack of structuring is revealed by "confusion, disarray, ad hococracy, muddling through, lack of organization, irrationality."

I take Structure to mean the organizational relationship between the source and the receiver. Such relationships can be determined by the organization's hierarchy or by its functions. An example of the former is where a superior seeks information from a clerk in her department. An example of the latter is where a hospital receptionist asks a patient for some information. Common to the two types of relationship is the idea of task: it is the superior's and clerk's job to talk to each other, just as it is the receptionist's duty to communicate with patients. Information flow is thus constrained by the roles individuals fulfill within the organization (Pfeffer 1982:98-102, 276; Rogers and Agarwala-Rogers

### **Hypothesis 3: Proximity**

A1: Individuals attempt to minimize the costs of obtaining information.

A2: Information is less costly to obtain from sources that are close by than from more distant sources.

TF: Information flow will be greater from proximate than from distant sources.

**Hypothesis 4: Structure**

A1: In order to attain its goals, an organization requires information to flow through certain channels.

A2: An organization rewards its members for performing work that helps it achieve its goals.

TF: Information flow will be greatest from those sources an individual perceives it his or her job to use.

**Hypothesis 5: Capacity**

A1: Individuals attempt to minimize the costs and maximize the benefit of obtaining information.

A2: Credibility is associated with the likelihood of information being correct and therefore of benefit to the receiver.

A3: It is convenient (costs are low and benefits high) to obtain information from sources that provide large amounts of information on a topic.

TF: Information flow will be greater from credible and complete sources than from those that are less credible or complete.

1976:77-107).

Organizations have goals and reward their employees for helping achieve them (Morgan 1986:19-38). One of the goals of an extension institution is to take information from various sources and to pass it on to farmers. It is the task of extension subject-matter specialists to perform part of this task. It follows that specialists should tend to use information sources they see it is their job to use (Hypothesis 4).

Structure proved an important influence on information flow in my Iowa study (Mundy 1989:185). Busch and Lacy (1983:88) found that U.S. agricultural scientists communicated more frequently with their departmental colleagues than with scientists in other departments or with extension staff. In many countries (including Indonesia), research and extension are separated administratively (Baharsjah 1985:30), and the inter-organizational barriers are high (Coulter 1983:52, Benor and Baxter 1984:94).

A frequent response to poor communications has been to adjust organizational structures to overcome these barriers (Kaimowitz 1989). Such revisions include changing the organization's hierarchical structure, shifting responsibilities among departments, combining organizations (such as research and extension) into a single body, forming joint

committees and working groups, and establishing new institutions (the AICs in Indonesia) or work roles (SMSs) to facilitate communication.

### **Capacity**

Capacity is operationalized by Havelock and Lingwood (1973:297) as "any sign of affluence, experience, wisdom, intelligence, strength, or size..." This definition seems to include two dimensions: the source's ability to provide large quantities of information, and the source's authoritative, credibility and trustworthiness. Both meanings can be applied to both people and impersonal sources: both people and publications can provide large quantities of information. Both source types may also be deemed authoritative, credible and trustworthy -- or indeed their opposites, depending on the receiver's experience with messages originating from them.

Capacity is important for reasons of efficiency of information seeking. We can view information seeking as an activity that incurs costs and provides benefits to the seeker (Atkin 1973). People prefer information from sources they regard as credible in order to reduce the risks of reduced benefits if the information turns out to be incorrect. They also should attempt to obtain information from the source with the greatest amount available so they can reduce their costs and the risk of having to go to other sources (Hypothesis 5). This is related to the idea of prolificacy (Hypothesis 1).

In interpersonal linkages, it has been well established that followers seek information from individuals with higher socio-economic status and education (Rogers 1983:277). Rogers cites 17 studies that support this contention. Capacity is also the factor at work in the hierarchical diffusion of innovations described by Brown (1981).

That Capacity may not always be important is shown by Rosenberg's (1967:124) finding that the amount of information respondents expected to obtain from a source did not affect the choice of source; however, ease of use was important (see below). Mundy (1989:187) also found Capacity to be irrelevant.

### **Openness**

Havelock (1969:11/24) regards Openness as "the readiness to give and to receive new information." This refers to individuals or organizations only. For this study, I use Openness to mean the ease of obtaining information from a source -- a concept that can include non-personal as well as personal sources.

A source may be willing or unwilling to divulge information, or may use scientific jargon or a foreign language. Similarly, publications may be written in a style difficult for a reader to understand. This is a charge often leveled at research reports, for instance.

Havelock (1969:11/24) includes in Openness the readiness of the source to give and to *receive* information. While willingness to accept feedback may be empirically correlated with readiness to provide it, these two ideas would appear to be conceptually distinct. Further, it is difficult to envisage how impersonal sources such as books can be

seen as open to feedback. Their authors can be open or closed -- but they are often unknown (see the discussion on sources earlier in this chapter). While the feedback concept may be important in interpersonal flows, we are therefore forced to disregard it because we are trying to compare across widely differing source types.

The Openness concept also is related to Atkin's (1973) idea of costs and benefits of information seeking. Sources that are Open are easier to use; since people try to minimize the expenditures they incur in seeking information, they will tend to choose the most Open sources (Hypothesis 6). This contention is supported by Rosenberg's (1967:124) finding that ease of use was a highly significant predictor of professionals' choice of source. He also found that ease of use (Openness) was more important than quantity of information obtainable from each source (Capacity). My earlier study of research-extension links at Iowa State University (Mundy 1989:188) found Openness to be important in determining choice of sources, but this relationship disappeared when other variables were controlled for.

## Reward

One of the characteristics of an innovation likely to lead to its rapid adoption is relative advantage (Rogers 1983:213). Information flow about such innovations is likely to be high, and audiences will attend to sources of such innovations. The selective perception hypothesis proposes that people attend to messages (and source types) that fit with their pre-existing schemata (Worchel, Cooper, and Goethals 1980:72). Uses and gratifications theories posit that people attend to sources that consistently provide them with gratifications. People are seen as having a variety of needs, which they attempt to fulfill by attending to the media (McGuire 1974). They will attend to the media that best fulfill these needs.

Common to these theories is the idea of *reward*. Receivers are likely to attend to information about topics which they deem relevant to their needs -- i.e., which provide them with some kind of reward. They will attend to information from a source when they estimate its reward value exceeds the expenditures incurred in seeking or avoiding it (Atkin 1973) (Hypothesis 7).

### **Hypothesis 6:** Openness

A1: Individuals attempt to minimize the costs of obtaining information.

A2: Difficulty in understanding or using information entails costs to the receiver.

TF: Information flow will be greater from sources that receivers regard as easier to understand and use.

**Hypothesis 7: Reward**

A1: Information flow may provide rewards for the receiver.

A2: Individuals seek to maximize their rewards.

TF: Information flow will be highest from sources that provide receivers with the greatest rewards.

In my study in Iowa (Mundy 1989:188), Reward -- or the relevance of information held by a source -- was a major influence on the amount of information obtained from that source. Sources with little relevant information generated low information flows. Research institutions in the developing world are often accused of failing to produce information that is relevant to farmers' problems. In the absence of relevant information, extension services are left with nothing to extend.

**Energy**

Energy refers to the amount of effort the receiver devotes to obtaining information from a particular source. Obtaining information involves expenditures of time and energy (Atkin 1973). While people generally try to keep expenditures to a minimum, high expenditures generally result in more information gain than do low expenditures. For instance, we will obtain more information if we search longer or devote more resources to the search (Hypothesis 8). This proposition received some support in my Iowa study (Mundy 1989:190), though the reliability of the Energy index in this study was doubtful.

Energy is another of the HELP SCORES variables that can apply also to the source -- if the source is a person or organization. Sources such as change agents who devote a lot of Energy to communicating information are more successful than those who do not (Rogers 1983:317). However, it is difficult to conceptualize a non-personal source as expending Energy. We are therefore forced to ignore the possibility of personal sources as expending Energy in order to maintain comparability with the non-personal sources in the study.

**Hypothesis 8: Energy**

A1: Obtaining information involves costs of time, effort and money.

A2: *Ceteris paribus*, increasing expenditures result in increased levels of information gain for a receiver.

TF: Information flow will be greatest from sources from whom the receiver devotes most effort to obtain information.

**Hypothesis 9: Synergy**

A1: People often fail to accept or remember information the first time it is presented.

A2: Information may become relevant to receivers only in certain situations or at certain times.

A3: Repetition of information increases the likelihood that individuals will be receptive to it.

TF: Information flow will be greatest from sources that repeat messages and time them favorably.

**Synergy**

The "coming together of forces, orchestration, combining of diverse elements, synchronization..." is denoted by Havelock and Lingwood (1973) as "Synergy." As formulated by Havelock and Lingwood, Synergy does not appear to reflect a single concept; rather, it includes at least two elements: repetition and timing.

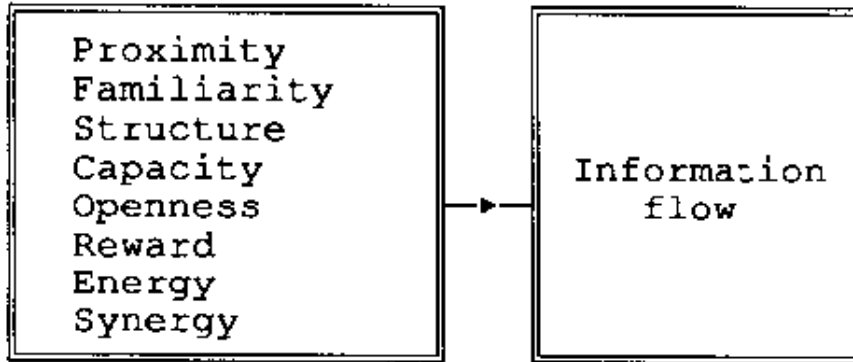
The importance of repetition (redundancy) in learning is well known. Repetition may involve the simple repeating of the same message (as with advertisements on television), or providing the message through different channels (as when the same product is advertised through television and magazines). Timing is related to the time and situational factors discussed above; people are receptive to information on a topic only at certain times (e.g., at the evaluation stage of adoption) and in some situations (e.g., when they learn a power plant is to be built next door) (Hypothesis 9).

Synergy is perhaps the least convincing of the HELP SCORES concepts. Conceptually, the ideas of timing and repetition are distinct, and they may not be related empirically. In my Iowa study (Mundy 1989:191), Synergy was reduced to the concept of timing because of low reliability in the original index. Even so, it failed to influence information flows.

**General model**

The changes in Havelock and Lingwood's list mean that the acronym HELP SCORES is no longer appropriate. Dropping Homophily and Empathy and switching Linkage to Familiarity gives the unfortunate abbreviation FP SCORES. Unfortunately these letters cannot be rearranged to form any new word, so I use this form to refer to the eight concepts below.

Characteristics  
of relationship  
between receiver  
and source



**Figure 5.3** Factors affecting information flow.

We can derive the following general hypothesis from the above discussion: we would expect the level of information a receiver obtains from a source to be influenced by the following aspects of the dyadic linkages between the source and receiver: Familiarity, Proximity, Structure, Capacity, Openness, Reward, Energy and Synergy (Figure 5.3, Hypothesis 10).

The model shown in Figure 5.3 is general enough to apply to a broad range of situations in which receivers can obtain information on a topic from a variety of potential sources. Such situations are frequent in communication within and between organizations and in the diffusion of innovations.

Studying agricultural extension personnel's information sources offers the opportunity to test this model. Extensionists can obtain information on agricultural technologies from a wide variety of personal and impersonal sources: scientists at various universities and research organizations, other extensionists, farmers, books, scientific and trade journals, training courses, etc. Despite the frequent complaint of poor research-extension linkages in developing countries, it clear that extensionists there *do*

**Hypothesis 10:** FP SCORES

Information Flow from a source to a receiver is influenced by the following aspects of the dyadic linkages between the source and the receiver: Familiarity, Proximity, Structure, Capacity, Openness, Reward. Energy, and Synergy.

obtain some types of information about technologies -- but it isn't clear *where* they get it and why.

The model proposed above provides a framework for investigating this problem. The eight causal variables suggested also provide research and extension managers with guidelines for improvements, since many of the variables are amenable to manipulation by managers. Organizational structures can be changed, for instance, to bring researchers and extensionists closer together administratively. Research publications can be rewritten to ensure they are more understandable (more Open) and directly relevant (provide greater Reward) to extension personnel. And training courses, field days and other activities can be timed or repeated to ensure high Synergy.

### **Model weaknesses**

The model proposed here has several weaknesses:

1. It does not predict which of the eight factors will dominate in determining information flows. The FP SCORES variables form a "laundry list": their relative importance must be determined empirically and may vary from case to case. For this reason I refer to the FP SCORES approach as a "model" rather than as a "theory."
2. Related to this, the model ignores the potential (indeed, the likely) relationships among the explanatory variables. Such relationships are suggested by Havelock (1969:11/31) and Havelock and Lingwood (1973:297). It is reasonable to expect, for instance, that one's position in an organizational structure is likely to affect one's physical proximity to potential sources: members of the same department tend to have offices in the same building, for instance. Similarly, the existence of strong (social?) links between a receiver and a source is likely to affect whether the receiver perceives the source as "open" or rewarding to work with.
3. The model fails to take into account variation in information flows over situations and time. Many information seeking activities are relatively short-term in nature, involve unique sources, and are unlikely to be repeated: you don't buy a new car very often. The theory seems better suited to longer-term or repeated information flows. We might expect such flows to vary over time as the situation adjusts, relationships between individuals change, and receivers become more adept at locating and using sources they find the most useful. A cross-sectional survey of the type described cannot measure such variations, but must assume they tend to cancel out in a large sample size and for a broad topic.
4. Because it is deliberately drawn broadly enough to include all possible sources of information, the model may omit characteristics unique to certain types of source. Two such characteristics were mentioned above: homophily and empathy, both of which seem less applicable to impersonal than to personal sources.
5. The model assumes information flow is one way, from source to receiver. I have deliberately excluded those elements of Havelock's model that are two-way in nature in order to be able to use it with non-personal sources. While the one-way assumption may be realistic for impersonal sources, it is less so if the source is a person.

6. A problem in all survey research is determining the direction of causality. While some of the independent variables are more likely to be causes rather than effects of communication (e.g., Structure and Proximity), others (e.g., Familiarity, Openness) can be (and in the literature often are) seen as consequences rather than antecedents of communication.
7. A final problem is the need to control for situation and topic. This imposes restrictions on any empirical test of the theory that may effectively confine such tests to specialized communication activities, such as the extension personnel study reported here.

### **Model strengths**

Despite these weaknesses, I believe this model offers several major advantages over others in the literature:

1. It takes a relational view of both information flows and their causal agents.
2. It enables us to compare information flows and their causes across different types of sources. Previous theories have either focused on the *total* amount of information a receiver obtains (ignoring differences among sources altogether), or have compared very broad categories of sources (e.g., newspapers vs. TV). The latter have failed to include either a wider range of sources or a more detailed breakdown of these categories. The theory proposed here allows as fine a breakdown of source categories as the researcher desires. For instance, a receiver may be questioned about "researchers" in general as a source, a particular group of researchers (such as those at the local university) or individual researchers by name.
3. It can be applied at different levels of analysis. Neither sources nor receivers need be individuals. Instead, the receiver could be conceptualized as a group or an organization, with little change in the explanatory or dependent variables used.

### **Summary**

Information flows are relational attributes of a source-receiver dyad. They are best measured from the receiver's perspective. They may vary across topics, messages, situations, time, receivers, and sources. It is necessary to control for each of these when studying information flows.

I hypothesize that information flows are affected by eight factors: Familiarity, Proximity, Structure, Capacity, Openness, Reward, Energy, and Synergy. Each of these factors can also be regarded as relational attributes of the source-receiver dyad.