Chatter Patterns: A Last Resort

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A possible method of identifying radio operators by their reaction to standard situations occurring in chatter, for use when conventional techniques fail.

BACKGROUND

The success or failure of most traffic analysis problems depends primarily upon the analyst's ability to achieve continuity.[1] Simply defined, continuity involves bridging a communications change by equating a given element appearing before the change with a different element appearing after it. The term continuity refers to the discovered relationship between the given element and its replacement, *without reference to the underlying meaning.* For example, we may by various methods discover that callsign ABC during November was replaced by DEF during December, and thus achieve continuity from ABC (November) to DEF (December). Note that the time factor is intimately involved in the relationship, since DEF replaced ABC. If, for example, ABC in November was found to be the same transmitter as GHI in November, the relationship between ABC and GHI is more accurately termed an equation or co-location and is not a continuity in its pure sense. Continuity can exist between ABC and DEF without any knowledge of the location, identity or function of ABC or DEF. The importance of the distinction between continuity and other forms of equation lies in the fact that once any knowledge is gained about ABC, it *automatically* applies to DEF (and vice versa). If we discover that

[1] A number of countries today go to surprising lengths to suppress in their communications systems distinctive characteristics which might serve to disclose their identity. Among the more common methods of suppressing characteristics is that of frequently changing certain communication elements, such as callsigns, frequencies, schedules, procedure, routing and address symbols. Since it is often necessary for the traffic analyst to study several months of material on a given net before concrete intelligence results can be developed, and since communications elements may change as often as twice each day, he must, somehow, find a way to nullify the effect of these frequent changes in order to pull homogeneous material together for study. He may note certain characteristics which do not change frequently (as, for instance that a given station sends a distinctive service message each day at 1100), which can serve as identifying features. When he is successful in nullifying a communications change, the traffic analyst refers to the result as *continuity*.

ABC served the Chief of Staff, 12th Division, Greenville, for his contacts with subordinate regiments on the Division administrative/logistic net, this information applies to DEF, in toto. On the other hand, about GHI we can only say (with any certainty) that it is located at Greenville. (Depending upon the type of equation made between ABC and GHI, we may further be able to say that GHI also serves 12th Division, or that it also serves an administrative/logistic function).

A direct cryptanalytic analogy to continuity can be recognized by considering a simple substitution system involving a matrix with changing coordinates. For example, the following matrix has been recovered for 1 April:

	4	2	1	8	.	.	.
2	A	D	R	L	.	.	.
9	P	B	O	C			
3	M	-	E	T			
1	-	K	N	-			
.	.						
.	.						
.	.						

On 2 April, assumption of the probable word "ATTACK" yields:

47	23	23	47	63	55
A	T	T	A	C	K

	7	5	-	3	-	-	-
4	A	D	R	L	.	.	.
6	P	B	O	C			
2	M	-	E	T			
5	-	K	N	-			
.	.						
.	.						
.	.						

It can then be stated, if the assumed word "ATTACK" proves correct, that row coordinate 4 on 2 April *is continuity of* row coordinate 2 on 1 April. It can also be shown that cipher value 57 on 2 April *is continuity of* cipher value 14 on 1 April. In this second case, we have achieved continuity without knowing what the actual plain value is. Finally, we can say that cipher value 43 on 2 April is continuity of cipher value 28 on 1 April. In this instance when 43_c (2 April) = 28_c (1 April) is proved, and 28_c (1 April) = L_p, then 43_c (2 April) = L_p.

The more frequently an element changes, the more important continuity becomes (since it is virtually the only consistent method for

achieving enough depth on a given element so that a study of its underlying nature and purpose can be undertaken), and the harder it is to get. Most of us can sympathize with the unfortunate analyst whose formerly stable problem suddenly adopts twice-daily changing callsigns, frequencies, addresses and discriminants.[1]

On problems involving fast-changing elements, continuity is usually achieved by means of whatever characteristics are available that can be trusted to be unique. If many are available, the easiest, fastest or most economical methods are, of course, tried first, while the more intricate and time-consuming methods are held in reserve for tough cases. It often happens that certain nets develop a stubborn streak which defies description (in mixed company) and, despite application of the most time-consuming routines, manage to remain intact and featureless.[2] Where all else has failed, the analyst may well find the following proposed routine useful.

INTRODUCTION

Most people are creatures of habit, particularly when performing a routine task, and radio operators are no exception. There has been considerable experimentation with and study of the variable characteristics of a Morse operator's transmitting habits or "fist" in an effort to develop a systematic process of recording and analysis which would permit ready recognition of the individual at the key. There is, however, a large area of variable operator habit which has remained virtually unexplored during recent years: habitual operator characteristics as displayed in routine chatter exchanges.

A good many traffic analysts can recall a specific instance where a unique or rare procedure signal was consistently used by a certain net or station and, in the last resort, could thus be relied upon to identify its user. There may be few, however, who can recall conducting a comprehensive and systematic search for such characteristics in order to achieve continuity and identification.

What follows is an outline proposal for a routine of systematic search for unique chatter or conversation characteristics which can be used for

[1] Traffic analysts will recognize that, for the sake of simplicity, the complexities of the various classes of equations and their accompanying validities have been avoided in this presentation. Other readers are warned that many a "Donnybrook" can and does develop between traffic analysts on these very factors.

[2] This situation tends to exist to a greater or lesser degree on most problems, although it can be appreciated that the point is ordinarily glossed over in discussion unless the words "additional personnel" are injected into the conversation at a suitable point.

continuity or co-location purposes. For the most part, specific details are avoided, except for examples, since they will vary from problem to problem. It will be seen that the routine is not readily usable on large problems, and may, in fact, be suitable only on limited problems where the area of inquiry is relatively small and all standard methods of achieving continuity have failed. An obvious prerequisite would be a significant volume of activity transmitted by the stations under study, with some assurance that a fairly complete (preferably verbatim) copy of chatter has been recorded by the intercept operator.

BASIC ASSUMPTIONS

It can be empirically demonstrated that regardless of the degree of conformity enforced by the target's COMSEC service, different operators use different combinations of procedure signals to express the same ideas, but that each operator tends to be consistent with himself.

The writer's contention is that these habits are more widespread than is generally supposed and that, under admittedly special circumstances, a *systematic routine will disclose* a sufficient number of them to permit continuity to be developed.

Expert chatter readers will recognize that operator chatter must be treated as a distinct, albeit peculiar, language.[4] Despite the best intentions of the signal officer who compiles an extensive set of procedure signals for radio operations, the "plain" side of his "code" is generally restrictive in nature. In actual operational use, a given procedure signal (prosign) tends to lose its rigidity and takes on a more general *concept* or *idea* form (particularly where it is used so often as to be easily recognized without "looking it up"). Thus the prosign QTR can be shown to have the fixed meaning "The correct time is ____ hours", whereas in actual usage among experienced operators, it embodies the general concept of *time* and is so used in a wide variety of contexts.[5] Complementing the tendency of experienced operators to generalize prosign meanings is the equally strong tendency to minimize and abbreviate words and prosigns in order to conserve both time and

[4] A more precise analogy has been suggested which compares chatter to a code book usage wherein (a) the vocabulary is not precisely suited to the material being encoded, and (b) the code is large enough so that code-clerks tend to use combinations of common, memorized groups in preference to rarer but more precise and economical groups which must be looked up each time they are needed.

[5] For example, the interrogative form "QTR?" is listed as "What is the correct *time?*" The *prosign QSY means* "I shall send on ———— kilocycles" and its interrogative form (QSY?) is interpreted as "On what frequency should I send?" or "Should I change frequency?" The compound "QTR QSY?" may well be used to mean "When should I change frequency?"

energy. "Ham" chatter displays this quite clearly.[6] It is not difficult to visualize how a relatively isolated segment of a radio network could gradually evolve a "local dialect" distinct from that of the rest as a result of improvisation under these pressures. Certainly a regimented COMSEC system with a firm domination over the radio schools could suppress some of this variation, but if we confine ourselves to studying experienced operators, it is likely that some recognizable variance and individuality will occur.

A SAMPLE PROBLEM

If distinctive operator habits do, in fact, exist, how do we go about finding and recording them? Evidently, if a way can be found to catalogue the *situations* that confront a radio operator most frequently, we can collect his *responses* to any given recurring situation and by observation determine whether his reaction is fixed by habit or is variable. For example, we might select as a favorable starting point several hours of intercept between station A and station B during which a number of messages were sent by each station. As a recurring situation, we might select *message transmission*, and further restrict our examination to the station responses during the period immediately before starting each message. We might find:

Example 1

A:	QTC	(I have traffic for you.)
B:	GA	(Go ahead.)
A:	C AS	(Yes, stand by.)
B:	C	(Yes.)
A:	BT	(Break Sign—attention, etc.)
A:	NR	(Goes into preamble.)

Examination of the same basic situation a short time later when station A was again about to transmit a message showed that after receiving "GA", station A *again* said "C AS" (Yes, stand by) and after receiving the affirmative from the other end began his transmission with a break sign. A third message still later in the same schedule begins with the same exchange and it now begins to look as if we have found a starting point.

A quick look at the activity of station B shows that the two messages it sent were also preceded by identical chatter exchanges:

[6] For example, the prosign "CUL" is a "Ham" contraction of "See or contact you later."

Example 2

B:	QTC AAA	(I have an "AAA"[1] message for you)
A:	AS	(Stand by)
B:	C	(Yes)
A:	GA	(Go ahead)
B:	C AS	(Yes. Stand by)
A:	C AS	(Yes. I'll stand by)
B:	C (pause) BT	(Yes. Break sign—attention)

(then into preamble)

Let us now examine what we have so far in the way of possible habits:

(a) When *offering* a "QTC," both station A (Example 1) and station B (Example 2) sent "C AS" after receiving "GA" from the other end. Each then preceded the preamble with "BT," but station B (Example 2) used the compound "C (pause) BT."

(b) When receiving a "QTC," station A (Example 2) responded with "AS" before giving the "GA," while station B (Example 1) gave "GA" immediately. When responding to "C AS," station B (Example 1) gave the brief answer "C," while station A (Example 2) used what may be a variant form—"C AS."

Later the same day, another exchange of messages is found between stations A and B. During this *later* schedule, two messages from station A are preceded by:

Example 3

A: QTC
B: GA
A: C (pause) VVV QTC
(goes into preamble).

and one message from station B is preceded by:

Example 4

B: QTC
A: GA
B: C AS
A: C
B: C (pause) BT
(goes into preamble).

[1] "AAA" in this instance refers to type or priority of message (e. g., "2nd priority" or "service").

It is quickly seen that the behaviour of station B is essentially unchanged, but that of station A shows no parallel with what went before. Our choice at this point is quite simple—either station A has changed operators or the "habit" is not sufficiently strong. The *resourceful* analyst would study carefully the chatter exchange during the opening of this second schedule for any evidence of a new operator at station A (extensive tuning, authentication, etc). If the "new operator" hypothesis does not appear sound, other types of habit must be sought. On the other hand, if it *does* appear sound, examination of suspected continuities from previous or successive dates should show *whether the time of change is fixed (i. e., the end of one duty tour and* the beginning of another). It would appear that once the duration and change times of operator shifts can be established, analysis can proceed at a much faster rate, since the change times will allow the analyst to sort activity for any given date into tentatively homogeneous groups.[5]

Thus far, our accumulated results are far from impressive. Where can we look for other habits? Two situations obviously related to the one examined above would be the area immediately following the message (message closure and receipting exchanges) and any "in-text" servicing (receiving station interrupting to ask for repeats while the *message is still being* transmitted) or "post-text" servicing (after the message is finished but before receipt is acknowledged), but there must surely be other areas which could be equally profitable.

TYPICAL SITUATIONS

We may find it useful to consider a typical schedule between two stations and examine the *successive situations which confront* the radio operator. Since certain of these will tend to recur within the same schedule (e. g., opening traffic, as in the example above), while others by their very nature, will tend to occur only once in any given schedule, it is convenient to distinguish between the two *types*, since the former is much more useful as a starting point (one is bothered less by possible operator changes, and only one schedule is generally needed for initial isolation of a tentative habit) while the latter comes into use, for the most part, after some initial foothold has been achieved. For purposes of convenience, we shall call the former *primary* and the latter *secondary habits*.

[5] Some care must still be exercised in watching for cases where extra operators are put on to cope with heavy traffic volumes, or for any other situation having the same effect.

1. Call-Up and Initial Contact

A surprising percentage of nets do not achieve immediate, or nearly immediate, contact, and extensive calling is therefore found frequently enough to be considered a regular source of habits. The calling operator (sometimes both ends are allowed to call) will often develop a fairly long and stylized *calling sequence* which is composed of several distinct elements. For example, one popular sequence appears thus:

Example 5

VVVVV ABC ABC ABC ABC DE DEF DEF
VVVV ABC ABC ABC ABC DE DEF DEF
VVVVVV ABC ABC ABC ABC DE DEF DEF QTC QSA?[9] R K

The calling operator may then pause, waiting for a response from ABC, and if none is forthcoming, repeat the full sequence and pause again. For purposes of convenience we may arbitrarily label the component elements of the calling sequence thus:

Tuning (V's)
Main Call (ABC . . . . DE DEF . . . .)
Closure (QTC . . . . . K)

The actual tuning character or characters are normally fixed by the signal officer, but the *number* of repetitions sent may be useful—unfortunately, however, few intercept operators can be relied upon for verbatim recording of a long and uninteresting series of V's. The only useful feature of the main call (in this example) is the *number* of times each callsign is sent. Empirical evidence suggests that this feature is usually fixed by the signal officer, and when it is not so specified it may be too variable to be useful as a habit. Likewise the *number* of main calls used in a calling sequence is usually specified by the signal officer, but where departures from specified practice are found, they may constitute reliable habits. But by far the most useful element of the calling sequence is the closure. A wide variety of prosign compounds are used here, and they tend to be habitual. The first response of the station being called is also a likely source of secondary habits, as is the first station's reaction to this response. At a minimum, signal strengths and readabilities are exchanged at this time. It is common practice for some nets to use callsigns only when making initial contact, for both brevity and security purposes, and under such circumstances, the point at which callsigns are consistently abandoned is sometimes useful.

[9] QSA?—"What is the strength of my signals?"

2. Tuning

Immediately after initial contact, various adjustments of tone, power, and frequency must usually be made before reception is considered good enough for the transaction of business. The exchanges may range from a short, terse and businesslike operation to a long, temperamental and often humorous argument. Unless they occur frequently, these longer-winded battles are of little use to the type of study being described,[10] and attention should be concentrated upon the shorter and more lucrative exchanges.[11] The first schedule after a frequency change usually contains much more tuning chatter than do subsequent schedules on that same frequency.

3. Recognition

Recognition exchanges may occur with or without a specific system such as an authentication chart or table of challenges and responses. They are most often seen on the first schedule after a new operator comes on duty, although some signal plans seem not to require their use unless messages are to be exchanged, while others obviously specify such use on every schedule. Many experienced operators prefer to rely on aural recognition of "fist" characteristics and frequently ask the other end to "send V's" (QSV) or adopt some other device toward the same end.[12]

4. Opening Traffic

The exchanges treated in some detail (see *Examples 1–4*) may be preceded by statements from *both* operators that they have traffic to be transmitted. In this situation, agreement must be reached on an order of transmission and such an exchange may be a good source of secondary habits.

5. Preamble and Text Handling

This category embraces a wide variety of characteristics, some of

[10] Except, of course, for the laudable purpose of recreation.

[11] In analyzing these exchanges, it is useful to remember that frequently the operator at the key does not have direct access to the transmitter itself and must relay adjusting instructions to a remote transmitter site by telephone.

[12] This use of QSV should not be confused with the more extensive use during tuning or equipment adjustments. When the sending occurs early in the schedule, it is not always easy to distinguish between the two, but its use in the recognition sense is usually unmistakable when, during later operations, consistent mis-encipherment of procedure, etc., arouses clearly recognizable operator suspicions about an operator's identity.

which are generally recognized as useful. In order to find *operator* habits, rather than *station* habits, one must recognize that the operator is here working from a printed or written record, so that the order of preamble elements, for example, is controlled (in most problems), by their arrangement on the message form while breaks and separators may generally be attributed to the operator himself. Here also belongs the situation where the operator realizes he has mis-sent a portion of the text, sends an error sign, and corrects the mistake. In this category, one is most definitely at the mercy of the intercept operator and one is likely to find him completely absorbed in copying the text (to the exclusion of non-textual transmissions).

6. "Break-In" Servicing

The receiving operator, under certain signal instructions, is allowed to "break-in" during text transmission to ask for verification or repeats of certain passages which he has missed or which seem doubtful. Where this happens (and where the intercept operator provides a verbatim record of the exchanges), primary characteristics may be found, since a number of prosigns are usually available for use in this situation, and requests for repeats can and do take several forms.

7. Closing Traffic

Most signal instructions will provide for some prosign such as BT, BK or K to mark the end of text, but some operators use additional compounds for emphasis, or to remind the other end that there are still more messages to be transmitted. As a special case, traffic sent by broadcast methods is usually sent twice, and the procedure used to separate the two consecutive transmissions frequently shows strong habit patterns.

8. Post-Message Servicing and Receipting

From the transmitting operator's point of view, a given message has not been "cleared" until the other end officially receipts for it. If the other end is not satisfied that his "copy" is correct, he will not give a receipt (QSL) until he has verified the questionable passages. Although the situation is slightly different from that described above ("Break-in Servicing"), habits found in one situation would be likely to show up in the other. As a special case, servicing may be asked for during a later schedule and, if it can be shown that the message has already been "cleared" (i. e., that a QSL was given), this "late" servicing may well result from an inability to decrypt the message.[13]

[13] Such information might be particularly useful to the cryptanalyst.

The servicing request in this instance may differ from "break-in" or "post-message" servicing only to the extent that the involved message must be clearly identified (i. e., by serial number or other unique indicator).

9. Breaks, Waits and Interruptions

We are here concerned, not with pauses which appear to be a fixed part of habits rising out of other situations (i. e., the pause before message transmission as shown in the first examples above), but rather with the non-routine or unexpected interruptions which cause temporary or permanent breaks in a given schedule. Among the situations which can be expected to produce habitual responses[14] are intervention of other schedules, equipment failures, interference, operator changes, shortage of transmitters and interruptions by other stations.

On especially long waits, the transmitting operator may key certain characters or compounds to "hold" the other end, in the general sense of "Hang on, I'm still here" or "Keep listening, I'll only be another minute or so." The actual signals sent during this "hold keying" may well be unique to each operator, but again we are dependent upon verbatim intercept copy if this characteristic is to be used.

10. Next-Appearance Discussions

Once the business of a given schedule has been transacted and the schedule is about to be terminated, some mention is usually made of the next appearance. Where contact times and frequencies are predetermined by the signal instructions, this mention is not likely to exceed a very perfunctory "Watch for me; I'll watch for you." On the other hand, the discussions may well involve times and frequencies. Either situation will yield useful secondary habits. As a special case, satisfactory contact may not have been achieved and ensuing discussions about another time and frequency may yield significant habits if the situation recurs.

11. Sign-Off

The actual termination of a schedule frequently involves a little ritual which is difficult to describe to one who has never heard it. Between operators who are used to working with each other it is

[14] Obviously, interruptions caused by flood, fire and other emergencies cannot be expected to appear often enough to be a fruitful source of habitual responses.

usually fairly rapid and highly stylized.[15] While this area should not be ignored as a source of habits, a departure from the routine specified in the signal instructions is frequently the result of tacit agreement between *both* operators and must be treated accordingly.

12. Special Circumstances

The above categories obviously do not complete the list of situations which may be useful on any given problem. If the net under examination regularly changes frequencies in mid-schedule, the chatter exchanges before and after each change merit some observation. Another special case involves the use of a matrix or table for prosign encipherment. Aside from the obvious benefits such a system can provide where local usage makes it effective for net or complex identification, the *use* of each *cell* in the matrix can be likened to the use of a comparable *prosign*. Thus, habitual use of certain cells or the formation of various compounds is just as useful as the prosigns themselves. This principle also applies to related systems, such as authentication, wherever habits can form as a result of allowing the operator a free choice in selection among a number of variables.

CONCLUSIONS

It will be evident that the proposed approach to maintaining continuity through chatter analysis has application only in limited cases. Because of its complexity, it may well be attempted only as a last resort and would undoubtedly require the services of a skilled chatter reader.

On some problems, one or two distinctive habits may be sufficient, while on others a wide variety of situations may need to be examined before individual operators can be distinguished. It may be found useful, when looking for habits, to keep a similar running record of those responses *which are the same for all operators*, on the theory that such responses have been specified by the signal instructions or form a "local dialect." Such a list would be helpful in later examinations of a related net or complex, since it would define situations where habits are *not* likely to be found. (It might also become a useful *net identification* tool.)

It should be emphasized that the "habits" we seek in this approach are not *tendencies* to act in a given manner, but are more nearly *instinctive* reactions or reflexes to recurrent stimuli. Where these reactions are found to be quite variable, it may be assumed that the operator concerned lacks sufficient experience to have developed such habits, or that the situation is rare enough so that he has not developed a reflexive response.

The approach may be useful, not only for continuity development in selected areas, but for inter-net equations after other evidence has narrowed the area of search to reasonable proportions, and to bridge communications changes where continuity is available both before and after, but not across, the change.

[15] A typical exchange sometimes used by U. S. personnel, where conformity to COMSEC regulations is not rigidly enforced, involves the transmission EF (dit, di-di-dah-dit) and the answer EE (dit, dit), which approximates the rhythm of the familiar "Shave and a haircut . . ."