How can we provide enough country-wide telephone

numbers to meet future growth, new services?

This new numbering plan is a practical answer

New Numbers for
Tomorrow's Telephones

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EACH WORKING DAY, about 17,000 telephones are added to the 76,000,000 now in use in the United States and Canada. That means 85,000 by the close of business each Friday, over 340,000 by the end of the month—more than four million by the year's end.

Providing the facilities that permit all the new millions of telephone users to communicate swiftly and easily is an undertaking of staggering dimensions. But there is an important behind-the-scenes aspect of meeting this rapid growth that is little understood and often taken for granted — the problem of providing telephone numbers. Yes, there are enough telephone numbers—now. But are there enough available to meet future growth and to satisfy the many new services as they appear on the horizon?

Most of the 17,000 telephones added today, tomorrow and the day after require a telephone number and all of them are or will be a part of the Direct Distance Dialing network. Within this framework, each telephone number that is used country-wide consists of ten characters which are distinctive and do not conflict with any other country-wide telephone number in the numbering plan.

Here, then, is the real question: Is there enough capacity in our present numbering plan to meet the needs of the future — is there enough to keep step with the steady increase in the use of the telephone in a time when distance is becoming less and less a barrier to communications?

It has often been said that a panoramic study of the past equips us more ably to predict the future. If this is true for social, political and economic changes, might it not also be helpful in forecasting telephone number requirements? So, before attempting to predict the adequacy of our numbering plan, let us pause and review the brief history of the present arrangement.

The Present System

By the middle 1930's, it was evident that the Operating Companies, in order to provide customers with faster, more accurate and more economical

long distance service and to keep pace with the ever increasing message volume, would have to turn to mechanization. This resulted first in "Operator Toll Dialing" and later in customer Direct Distance Dialing (DDD), whereby the long distance operator or customer could dial directly to the desired telephone.

In implementing this program for mechanization, a numbering system was a necessity. Each telephone in the United States and Canada, whether Bell owned or independent, required a

Additional Numbering Plan Area *codes have been required in 26 states and provinces since 1947. Here C. M. Conway, C. Clos, T. V. Ashton, J. P. Ringland of A. T. & T. Traffic discuss the introduction of two new numbering plan areas in northern California.*
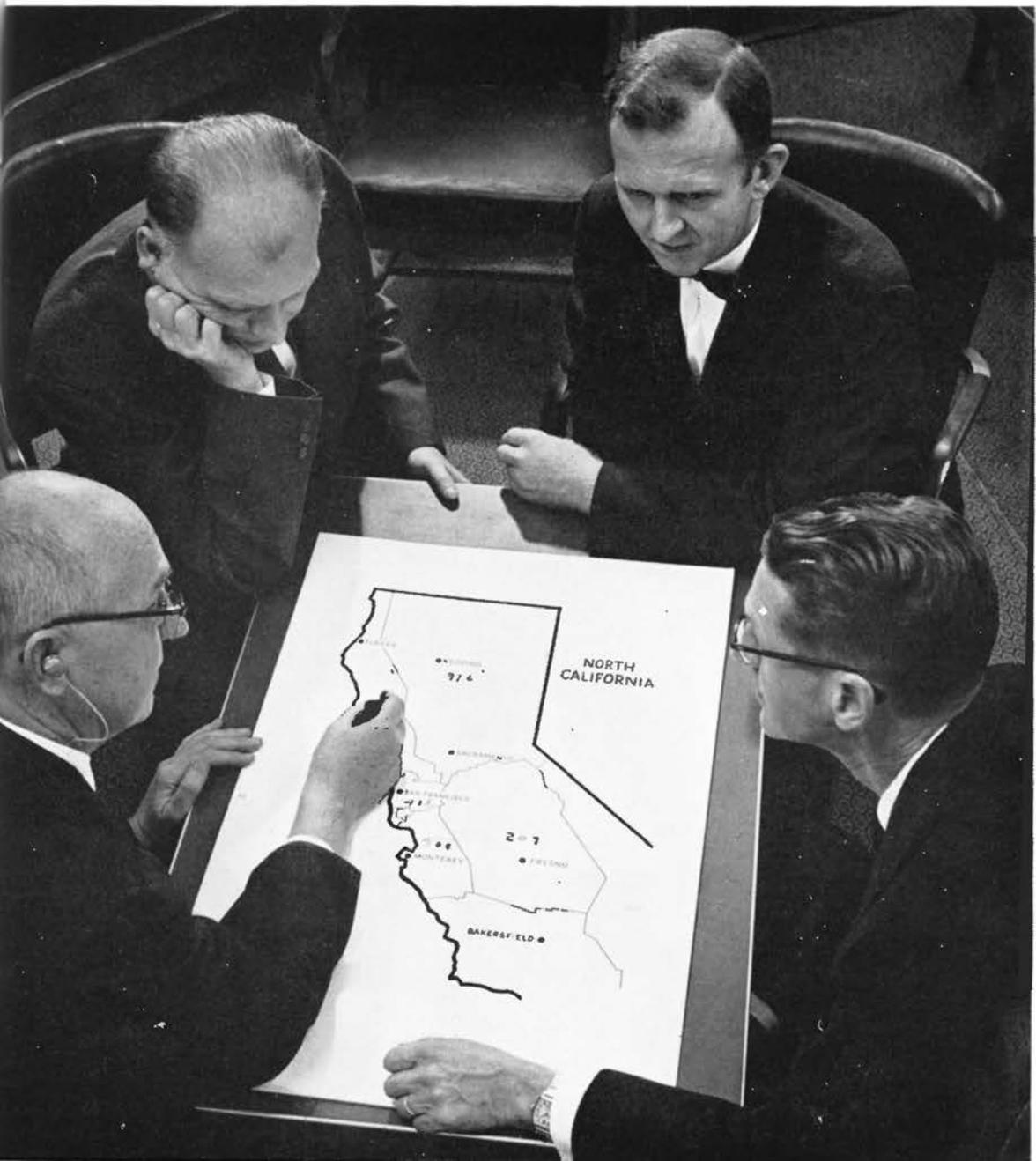
country-wide number. As a result, our present numbering plan was adopted. Under this system, local numbers consisting of the first two letters of a central office name plus five numerals are used over and over again. Country-wide numbers consist of the local number preceded by a distinctive three-digit area code, thus resulting in a ten-character number, as for example 718 TRiangle 3-9970.

Under the present numbering plan, the first three numerals of the ten characters always have "0" or "1" as the middle numeral. These three numerals identify the specific area (Numbering Plan Area—"NPA") in the United States or Canada to which a call is to be directed. The next three characters, known as the central office code and distinguishable because of the letter designations and the absence of "0" or "1" in the middle, identify the appropriate local central office within the NPA while the last four numerals constitute the telephone line number.

With ten numerals on a telephone dial, there are potentially 200 (10 x 2 x 10) NPA codes available. However, the numeral "0" is used for reaching the operator and the numeral "1" was not initially considered usable as the first numeral of an NPA code because of the need to protect against preliminary pulses. Such pulses usually resulted from unintentional operation of the switchhook before dialing. Therefore, there are 160 (8 x 2 x 10) potential NPA codes. Of these, 152 are reserved for NPA code use and 8 (those with the numeral "1" in both the second and third places) are reserved for information, repair and other special services.

In 1947, 86 NPA codes were assigned in the United States and Canada. This code requirement was based on the

"ultimate growth requirements in central offices" for both Bell and independent companies and reflected "a forward looking estimate for a long period of years."

Numbering plan area boundaries were drawn to coincide with state and province boundaries wherever possible to assist operators and customers in identifying the proper NPA code. One code was adequate for each of the
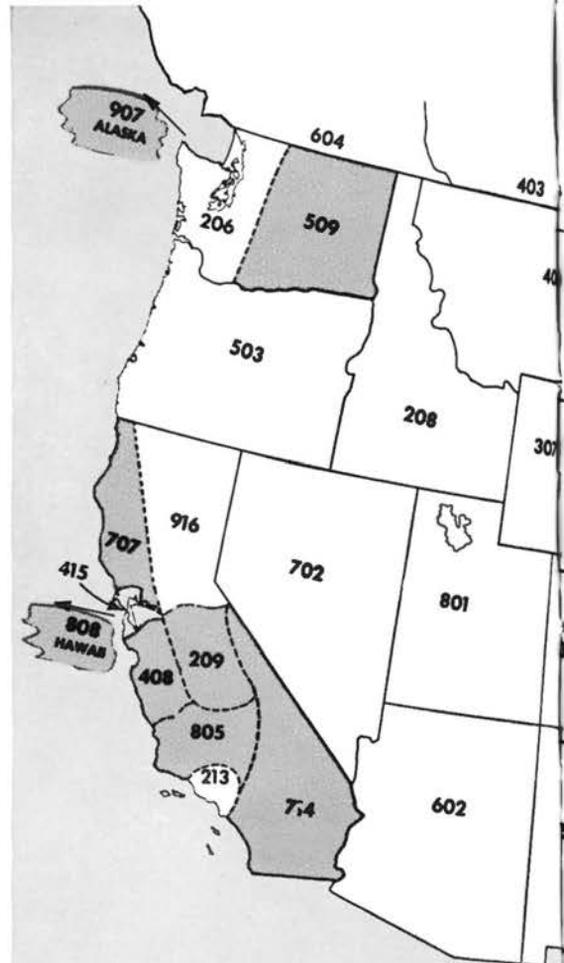
The numbering plan area assignments as of January 1, 1960 are shown above. There are 117 numbering plan areas in the U. S. and Canada now compared to 86 in 1947. Color shows where new area codes have been assigned.

states and provinces except for 16 where two or more were necessary.

Needed: Greater Capacity

A margin of 66 (152—86) unassigned NPA codes was thought to provide adequate safety in the capacity of the numbering plan to meet all unforeseen developments beyond 1947. Yet, in the ensuing 12 years, assignment of 31 additional codes has been necessary. The number of states and provinces requiring two or more NPA codes has grown from 16 to 26 during this period.

The rapid post-war telephone growth has been largely responsible for the need for the additional area codes. Today, only 12 years after the numbering plan was conceived, it is anticipated that its capacity will be exceeded by the mid-1970's.

NUMBERING PLAN AREAS WITH CODES
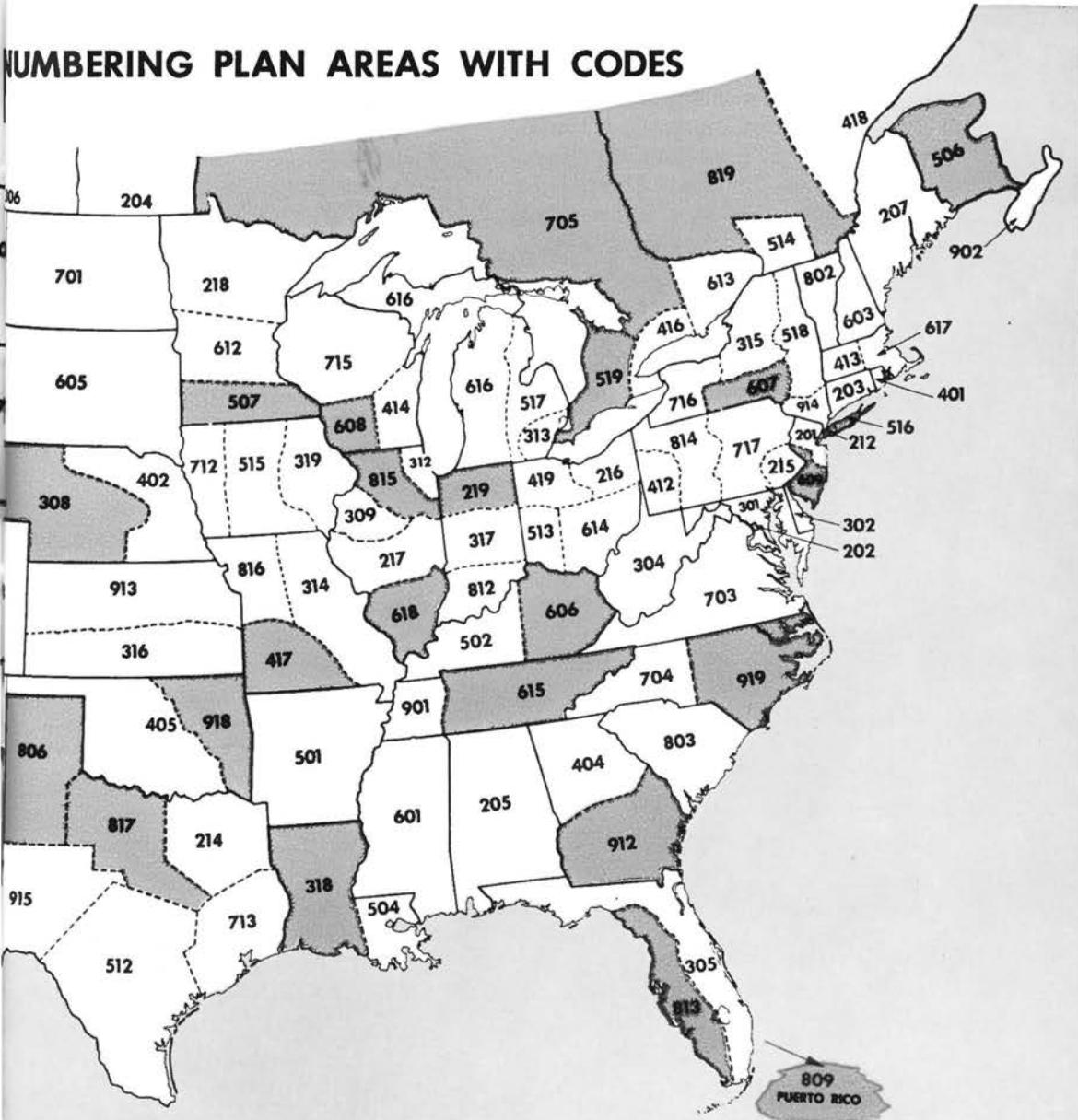
Uniformity and Flexibility

Besides the need for a numbering plan of greater capacity in the forseeable future, there are some current but associated considerations involved.

For the most successful use by customers of Direct Distance Dialing service, it is very important that the dialing procedures be uniform, uncomplicated and easy to understand. Unfortunately, the wide variety of facilities already in service has brought about considerable non-uniformity. For instance, customers making DDD calls to Newark, New Jersey, dial seven characters from Asbury Park, nine from New York City, ten from Harlingen, Texas, 12 from Hamilton, Ohio, and 13 from Hartford, Connecticut. Uniformity in the way a customer dials should be a major objective in any expansion of our present plan.

Another consideration in any change in the numbering plan is the flexibility with which new services can be introduced and existing services expanded. An example is customer dialing of person-to-person and other special calls that now require full operator handling. Under present thinking, a customer will place this type of call by dialing a prefix followed immediately by the desired seven or ten-character number.

With this service, an operator will be automatically connected to the line just long enough to determine the type of call (e.g., person-to-person, collect, charge to third telephone, etc.) and to take appropriate action. Billing information will be automatically recorded. To date, this new service has been used successfully in two trial offices and customers like it.

Besides direct dialing of person-to-person and special calls, any long range numbering plan must be adaptable to such services as push-button telephones, direct dialing to mobile telephones and to personal signaling sets, direct in-dialing to P.B.X.'s whereby each extension served requires a country-wide telephone number, international dialing and others not forseeable at this time.

Why Act Now?

Our present plan appears adequate for the next ten to 20 years. Is it premature to decide now on how best to expand that plan?

The answer: It is not too early by any means.

Equipment modifications will eventually be required in hundreds of local and toll dial switching offices. These modifications could be extremely costly if made on a "crash" basis. On the other hand, expenditures can be minimized by modifying the switching equipment in conjunction with other equipment changes, e.g., changes required for customer dialing of person-to-person and similar traffic, or in connection with normal additions for growth.

New Numbering Plan

Extensive studies have been made during the last few years to determine the most suitable dialing plan for the future. The studies have included the possibility of eight-character local numbers, of four-digit area codes, the provision of a separate button on telephone sets to identify subsequent digits as NPA codes, and others. However, as the studies have progressed, there seems to be considerable merit in retaining the basic structure of the ten-character concept for country-wide numbers. This will tend to minimize customer difficulties during the transi-

tion period and keep the number of characters at a reasonable level.

With this premise, any substantial increase in country-wide telephone numbers must be achieved by overcoming the current limiting feature on the number of NPA's, i.e., the "0" or "1" in the middle place of the NPA code. In other words, provision must be made for using codes with additional numerals in the middle.

Looking ahead, we see that the large majority of all DDD calls will require a prefix. This comprises all person-to-person and special DDD calls and those station paid DDD calls that originate in offices where the type of equipment requires a directing code to reach the long distance network. (Over half of the total customers are served by such offices.) By adding a prefix to only the remaining station paid DDD calls, the new NPA codes can be identified and uniformity in customer dialing can be achieved.

As a result of these and other considerations, the dialing procedure as shown in the table below is planned for general adoption.

With this new dialing procedure, the prefixes "1" and "0" will serve multiple purposes. They will signal the switching equipment that a DDD call is being originated and hence the next three characters may be an NPA code. If the three characters are used either as a central office code in that specific area or a distant NPA code but not both, the dial equipment is able to identify the type of code and route the call properly. If, however, there is a conflict and the code is used for both purposes, further identifying information is required. Receipt of only seven characters following the prefix identifies the first three as a central office code, otherwise an NPA code.

In addition to the use of the "0" prefix for identification of an NPA code, it will also signal the switching equipment to connect an operator to the line on person-to-person type DDD calls. If no characters are dialed immediately following "0", the equipment routes the call to the regular operator.

Use of the prefixes "1" and "0" to identify potential area codes is a Bell System long-range objective. However,

DIALING PROCEDURES ADOPTED BY THE BELL SYSTEM

Local calls	7 characters
Station-to-station sent paid calls	"1" + 7 or 10 characters
Person-to-person, and special calls . . .	"0" + 7 or 10 characters
Assistance calls	"0"

in some connecting companies these prefixes may not be feasible. In such instances, other prefixes may be substituted. A substitution, however, does not affect the basic ten-character number concept or the capacity of the expanded numbering plan.

With this prefix plan, what has happened to the number of NPA codes available? Instead of 152 codes of the type with "0" or "1" in the middle, 800 (8 x 10 x 10) will be available with the expanded plan. A sizable increase to say the least!

Central Office Codes

Perhaps we might stop here. But if a prefix is employed to identify a potential NPA code, might not the absence of a prefix be used as identification of a central office code? Might not codes with "0" and "1" in the middle be assigned in the future as central office codes, thus increasing the number of these codes? Might it not be desirable to examine our basic two-letter five-numeral structure of local numbers to determine its adequacy?

First, let us look at some of the reasons for more central office codes.

They will be particularly important in large metropolitan areas. The extensive use of direct in-dialing to PBX's, plus direct dialing to mobile telephones and to personal signaling sets, etc., will result in a sizable increase in the need for central office codes.

One solution, with more NPA codes available, is to split the areas affected into two numbering plan areas. This approach solves the shortage of central office codes. But where does it leave the customer within these areas? He would be required to dial 11 characters to reach many of the same subscribers that he formerly could reach by dialing either seven or eight — more characters

required and more dialing errors.

Another and possibly a more serious problem is that the country-wide telephone number for perhaps half of the customers in the original NPA would have to be changed. Customers with DDD in other areas that have occasion to make calls to customers with new country-wide telephone numbers would have to be informed of the change through instruction media, by operators, and other means.

So a better solution would be one whereby more central office codes are obtained. How can this be done? Change the dial to put letters in the "0" and "1" places? Rearrange the letters on the dial to permit suitable names for each numerical combination? Both sound simple, but consider that it would require an installer's visit to change the dial plate on each of the 76 million telephones in the United States and Canada. And, if letters were rearranged, it would mean a number change for millions of telephones. Also, the whole process would have to be accomplished on a "flash cut" basis. Indeed, neither is a practical answer.

'Name' Problems

Even if the dial could be redesigned to make more codes available, the two-letter five-numeral system with central office names is not entirely satisfactory. Customers and operators continue to misspell names, e.g., MU instead of ME for Mercury, LI instead of LY for Lyric. This results in unsuccessful attempts, wrong numbers, customer irritation and occasionally serious customer complaints. Similarly, confusion when dialing between the letter "O" and the numeral zero, and the letter "I" and the numeral one, presents the same problem.

Customers occasionally object stren-
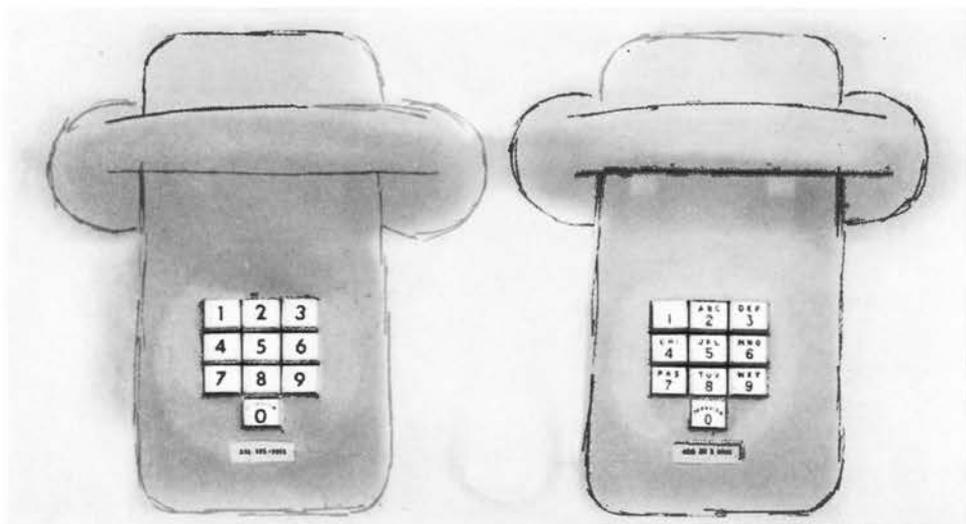
All-Number Calling *would eliminate the need for letters on telephone dials or push buttons. Artist's conception compares conventional and all-numeral button arrangements.*

uously to a particular name selected for their local central office. Objections may be based on the premise that the name selected, GYpsy for example, does not enhance the prestige of their town. The Chamber of Commerce in a locality known as the "Garden Town" objected when "GArden" was assigned as a central office name in a nearby community. A stock insurance company objected to the name "MUtual." Use of names requires a continuing public relations program.

Further, a trend on the part of customers away from using central office names has been developing. Many are using, instead, the first two letters of the name. This is particularly evident in advertising media—billboards, classified ads, displays on motor vehicles. This is a natural trend. All the dial switching equipment requires to complete a local call is seven characters, the first two of which can be letters. Why not adopt this? It sounds logical and sensible—saves space and serves the purpose.

One drawback however—standard central office names were selected to minimize phonetic conflicts and, when spoken, offer little confusion. CEdar, DEwey and TEmple are quite distinctive phonetically. But CE, DE, TE— the letter counterparts—may cause some confusion because of the "E" sounds.

All-Number Calling (ANC)

What appears to be needed is not a numbering system that perpetuates names or letters but one that eliminates them. All-numeral telephone numbers provide such a system. This system is not dependent on letters on the dial or on suitable names for particular combinations of characters. Hence, it makes available additional central office codes and, in addition, eliminates the disadvantages of names and letters. With the new dialing procedure, approximately 800 instead of the 540 usable central office codes under the present numbering plan would be available. Furthermore, ANC can be

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introduced on a progressive basis. During transition it can be used right along with the present type of numbering by retaining the lettered dial during this period—no problem.

Seven-digit All-Number Calling was first introduced in the Bell System on a trial basis in Wichita Falls, Texas, in January 1958. Previous Bell Laboratories experiments had shown that it was a faster, more accurate system than names, and a field trial was arranged. The trial showed that customers liked the system; that they dialed numbers more quickly and with fewer errors and found it easy to use.

The ability of customers to remember all-numeral numbers has been considered. This ability is difficult to evaluate through a field trial. Consequently, extensive experiments were conducted to determine customer's long and short-term memory ability as well as the way this ability affects performance. Results indicate that all-numeral telephone numbers are about as easy to learn as those with names or letters. Dialing performance was actually somewhat better with ANC.

Based on the favorable results of the trial, ANC is now recommended for all Bell System offices not yet converted to two-letter five-numeral numbering. The initial introduction in a large city will take place in Omaha, Nebraska in September 1960. Methods of converting those cities now on a two-letter five-numeral basis to ANC are now being studied.

Eventually, with ANC there will no longer be a need for letters on the dial. This will reduce the characters now standard on Bell System dials from 34 to 10 (excluding the "operator" designation) and will permit miniaturization of dials or push buttons without impairing their legibility.

With the prefix plan and All-Number Calling, two-way international dialing by customers will be facilitated. The letters or characters used on dials differ from country to country, but the Arabic numbering used on the dials is practically universal. Many foreign countries now use or plan to use all-numeral telephone numbers—e.g., Venezuela. Australia, Japan, Germany.


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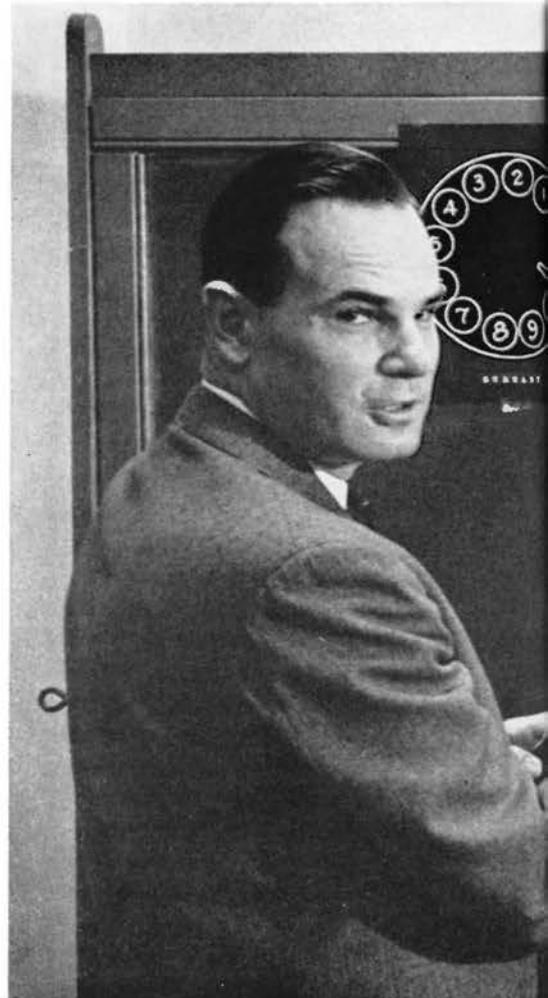
What Do We Gain?

The combination of All-Number Calling and the increase in NPA codes will permit an eightfold increase in country-wide telephone numbers. This will provide enough capacity to take care of our needs in the forseeable future.

Beyond that, in a world where the divergence of ideas and ideologies is vast but where the physical barriers to communication are rapidly disappearing, the means to keep these ideas in constant, easy interchange not only neighbor-to-neighbor and state-to-state but nation-to-nation is of increasing importance. Something as basic as a telephone dial that is a "common denominator" among nations might, by facilitating the flow of communication, have its effect upon our ability to live together within "one world."
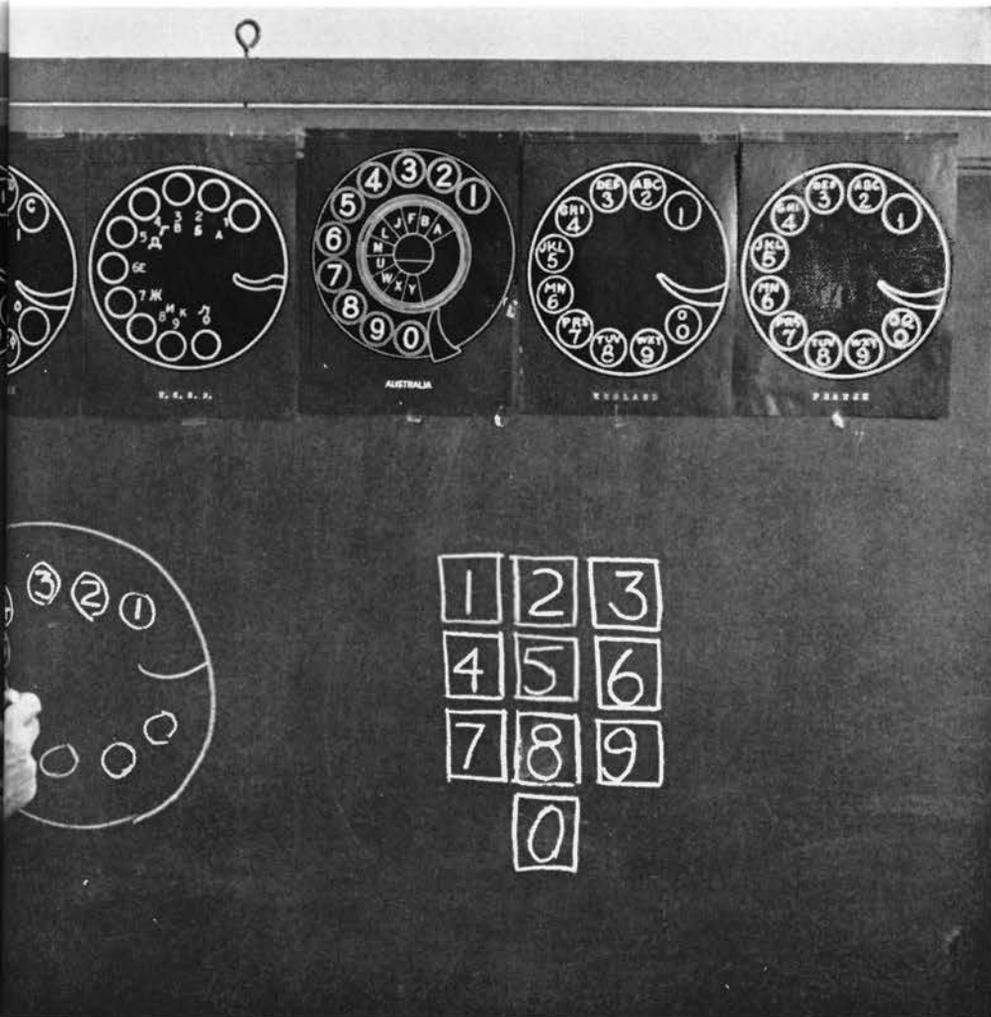
Arabic numbering *is almost universal; therefore All-Number Calling, besides its many other advantages, will facilitate international dialing. The author demonstrates this common denominator on German, Danish, U. S. S. R., Australian, English and French dials..*