TWO-WAY COMMUNICATION CHANNELS

CLAUDE E. SHANNON
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS

1. Introduction

A two-way communication channel is shown schematically in figure 1. Here x_1 is an input letter to the channel at terminal 1 and y_1 an output while x_2 is an

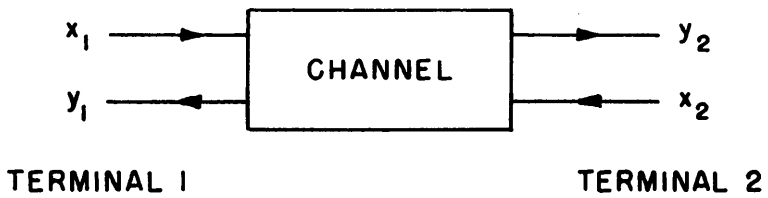

FIGURE 1

input at terminal 2 and y_2 the corresponding output. Once each second, say, new inputs x_1 and x_2 may be chosen from corresponding input alphabets and pút into the channel; outputs y_1 and y_2 may then be observed. These outputs will be related statistically to the inputs and perhaps historically to previous inputs and outputs if the channel has memory. The problem is to communicate in both directions through the channel as effectively as possible. Particularly, we wish to determine what pairs of signalling rates R_1 and R_2 for the two directions can be approached with arbitrarily small error probabilities.

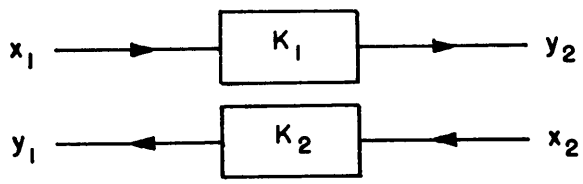

FIGURE 2

Before making these notions precise, we give some simple examples. In figure 2 the two-way channel decomposes into two independent one-way noiseless binary

This work was supported in part by the U.S. Army (Signal Corps), the U.S. Air Force (Office of Scientific Research, Air Research and Development Command), and the U.S. Navy (Office of Naval Research).