and the *Census,* the figure of the agent himself has been seen by the percipient.

The so-called reciprocal cases are evidentially of much im­portance. Each of the two persons concerned appears to receive a telepathic impulse from the other, so that each receives information about the other, or sees his phantasm.

Occasionally telepathic impressions from animals to human beings are reported, but the facts are usually far from well estab­lished. Telepathic communication has also been suggested as the explanation of the simultaneous movements of large flocks of birds.

Various theories have been put forward to account for telepathy, but they only agree in the total lack of an experi­mental basis. Broadly speaking, they are divisible into physical and psychical. Sir W. Crookes suggests that transmission is effected by means of waves of smaller magnitude and greater frequency than those which constitute X rays. Undulations starting from nervous centres are adopted as the explanation by Prof. Flournoy and others. But Myers and others regard the case against a physical explanation as complete. The main difficulty in the way of it is that the strength of the impulse does not seem, in the spontaneous cases, to vary with the distance, as by all physical laws it should. On the other hand, a curious phenomenon has been noted in experiments; if the percipient gaze at an arrow with its head turned to the right, there is a tendency, disproportionately strong if we suppose that chance alone operates, for the arrow to be seen reversed. This fact is, however, more important in all proba­bility for the light which it throws on the mechanism of hallu­cinations (*q.v.*) than on that of transmission. Telepathy is often invoked as an explanation of the facts of mediumship (see Medium, and Possession); but it seems insufficient to explain them unless we assume for the medium a far greater power of reading other people’s minds than experimental evidence has so far shown to exist.

Bibliography.—Gurney, Myers and Podmore, *Phantasms of the Living·,* Report on the Census of Hallucinations in *Proc. S.P.R.,* x. ; Podmore, *Apparitions and Thought Transference;* Mrs Sidgwick in J. Μ. Baldwin’s *Dictionary of Philosophy* s.v. *Telepathy;* N. W. Thomas, *Thought Transference* (1905), containing a list of the im­portant articles in the *Journal and Proceedings of the S.P.R.* and other publications. See also Crystal Gazing. (N. W. T.)

**TELEPHONE** (Gr. τήλe, far, and *φάνη,* voice). Telephony is the art of reproducing sounds at a distance from their source, and a telephone is the instrument employed in sending or receiving such sounds. The term “telephony” was first used by Philipp Reis of Friedrichsdorf, in a lecture delivered before the Physical Society of Frankfort in 1861.@@l But, although this lecture and Reis’s subsequent work received considerable notice, little progress was made until the subject was taken up between 1874 and 1876 by Alexander Graham Bell, a native of Edinburgh, then resident in Boston, Mass., U.S.A. Bell, like Reis, employed electricity for the reproduction of sounds; but he attacked the problem in a totally different manner. This will be better understood if we consider shortly on what the chief characteristics of sound depend.

The sensation of sound is produced by rapid fluctuation in the pressure of the atmosphere on the tympanum of the ear. If the fluctuations are irregular and non-periodic, the sound is called a noise; if they are cyclic and follow a regular and sufficiently rapid periodic law, the sound is musical. In connexion with the present subject it is important to notice the three characteristics of a musical sound, namely, *pitch, loudness* and *quality.* The pitch of a musical sound depends on the number of cycles passed through by the fluctuations of the pressure per unit of time ; the loud­ness depends on the amount or the amplitude of the fluctuation in each cycle; the quality depends on the form or the nature of the fluctuation in each cycle. The necessary condition for a successful system of telephony is the ability to reproduce these characteristics.

In 1831 Wheatstone by his “ magic lyre” experiment showed@@2 that, when the sounding-boards of two musical instruments are connected together by a rod of pine wood, a tune played on one will be faithfully reproduced by the other. This only answers, however, for telephoning musical sounds to short distances. Another and somewhat similar example is furnished by what has been variously designated as the “ string,” “ toy,” “ lovers,” and “ mechanical ” telephone. Two disks of thin metal, or two stretched membranes, each furnished with a mouthpiece, arc connected together by a thin string or wire attached at each end to the centres of the membranes. A good example may be made with two cylindrical tin cups; the bottoms form the membranes and the cups the mouthpieces. When the connecting string is held taut and sounds, such as those of ordinary speech, arc produced in front of one of the membranes, pulses corresponding to the fluctua­tions of the atmospheric pressure are transmitted along the string and communicated to the other membrane, which in its turn communicates them to the air, thus reproducing the sound. In both these examples all the three characteristics—pitch, relative intensity, and quality—of sound are reproduced.

In July 1837 Dr C. G. Page of Salem, Mass., drew attention to the sound given out by an electromagnet at the instant when the electric circuit is closed or broken, and in October of the same year he discussed, in a short article @@3 entitled “ Galvanic Music,” the musical note pro­duced by rapidly revolving the armature of an electromagnet in front of the poles. Experiments bearing on this subject were subsequently made by a great number of investigators@@4 Page’s discovery is of considerable importance in connexion with the theory of action of various forms of telephone, and was a very important feature in the early attempts by Reis to transit music and speech. On the 26th of August 1854 there appeared in *L’Illustration* (Paris) an interesting article by Charles Bourseul on the electric transmission of speech.@@5 The writer recommended the use of a flexible plate at the source of sound, which would vibrate in response to the varying pressure of the air, and thus open and close an electric circuit, and of a similar plate at the receiving station, which would be acted on electro-magnetically and thus give out as many pulsations as there are breaks in the current. These suggestions were to some extent an anticipation of the work of Reis; but the conditions to be fulfilled before the sounds given out at the receiving station can be similar in pitch, quality and relative intensity to those produced at the transmitting station are not stated, and do not seem to have been appreciated.

In Reis’s lecture an apparatus was described which has given rise to much discussion as to priority in the invention of the telephone. The instrument was described in over fifty publications@@6 in various countries, and was well known to physicists previous to Bell’s introduction of the electric telephone as a competitor with the electric tele­graph. Reis caused a membrane to open and close an electric

@@@1 “ Über Telephonic durch den galvanischen Strom," in *Jahresber. d. physikalischen Vereins zu Frankfurt am Main,* 1860-61, p. 57.

@@@2 See his *Scientific Papers,* p. 47.

@@@3 See *Silliman’s Jour.,* xxxii. 396, and xxxiii. 118.

@@@4 Marrian, *Phil. Mag.,* 3rd ser., vol. xxv. p. 382; Beatson, *Arch. de l'Élect.,* v. 197; De la Rive, *Treatise on Electricity,* i. 306, also *Phil. Mag.,* 3rd ser., vol. xxxv. p. 422, and *Comp. Rend.,* xx. 1287, xxii. 432; Matteucci, *Arch. de I'Élect., v. 389;* Guillemin, *Comp. Rend.,* xxii. 264; Wertheim, *Comp. Rend.,* xxii. 336, 544, xxvi. 505, also *Ann. de Chim. et de Phys.,* xxiii. 302, and *Phil. Mag.,* 3rd ser., vol. xxviii. p. 544; Jannair, *Comp. Rend.,* xxiii. 319; Joule, *Phil. Mag.,* 3rd ser., vol. xxv. pp. 76, 225; Laborde, *Comp. Rend.,* 1. 692; Poggendorff, *Pogg. Ann.,* lxxxvii. 139, xcviii. 198; Du Moncel, *Exp. de I'Élect.,* ii. 125, iii. 83; and Delesenne, *Bibl. Univ.* (1841), xvi. 406.

@@@5 See also *Didaskalia : Blatter für Geist, Gemüth, tι. Publicitãt,* Frankfort, No. 232, 28th September 1854: Du Moneel, *Exposé des Applications de l’Électricité* (Paris), ii. 25, ed. 1854; iii. 110, ed. 1856, and *Comp. Rend.,* 26th November 1877.

@@@6 The English reader may consult—*Jour. Soc. Tel. Eng.,* March 1883; *British Assoc. Rep.,* 1863; *Civ. Eng. and Arch. Jour.,* xxvi. 307; R. Μ. Ferguson, *Electricity* (London, 1866), p. 257; S. P. Thompson, *Philipp Reis, the Inventor of the Telephone* (London, 1883).