

50 per cent "errors" of the monkey are fully explained without the necessity of assuming a complex effect.

One could object to this explanation that it is improbable that a negative sign would obtain a decisive valence although there was no punishment, while there was a reward (food) in the case of the positive sign. This, however, is by no means uncommon. It is very instructive to compare these results with experiments carried out much earlier by Breed.⁶ This author trained fowls to discriminate between colours, for example, black from blue. When selecting blue the birds were punished by an electric shock, while in the case of a correct choice (black) the only reward was that the birds could see or join their companions again. As the negative stimulus was here the "emphatic" one, Breed expected that the birds would react indifferently when the negative sign was replaced by a new one—and so it was, at least in the majority of the cases. Even the brightness of the colours did not matter at all as these birds reacted in the same way to white-blue as to black-blue—the response being one of "getting-away-from-the-blue-no-matter-what-the-other-colour." But this did not happen in all cases, for Breed found to his surprise in three out of eight birds that they responded "definitely and positively" to black, but not negatively to blue. These three birds were quite lost when white accompanied blue, although the training procedure had been exactly the same in both cases. "With these chicks black (+) seemed to be the guiding stimulus" (p. 69), that is, they acted only according to the positive sign although this was not the emphatic one.

Breed tried to summarize his results in a general statement. He was perhaps not quite fortunate in expressing it in the following words (p. 78): "Psychologically, it seems, negation is not affirmation". Apparently he wanted to say that if we train an animal to discriminate between two stimuli, the creation of a negative valence for one of them does not necessarily mean that the other one obtains automatically a positive valence for the subject in question—and vice versa. The importance of this fact for experimental work on discrimination is obvious.

To avoid any misunderstanding, I should mention that often a complex effect can indeed be primarily decisive in discrimination tests, for one need only recall the well-known experiments carried out by W. Köhler⁷ on the "structural function" (the relative choice) present in the domestic fowl and chimpanzee. Here the response was definitely to a relation between two stimuli (for example, between two different shades of grey), but Köhler was much too careful to claim that this was the only possible way of learning. The learning effect fixed to absolute characters is in his opinion only of short duration, while the effect of the "structure of the pair" is better fixed. This difference in fixation, however, is by no means sufficiently examined and would no doubt provide material for interesting psychological work. For the time being we have therefore in every discrimination test to examine not only the effect of the pair, but also of each of its single components.

RECONSTRUCTION IN OXFORD AND LIVERPOOL

THE second part of the report of the Committee on Planning and Reconstruction of the Oxford Preservation Trust, which has recently been issued, makes a number of detailed recommendations. Turning first to the new civic centre, it is recommended that it should be located where the three roads from Headington, Iffley and Cowley converge, a sufficient area being also allocated for a proper shopping centre for the eastern half of Oxford, including a new covered market. The St. Ebbe's area should be re-planned, the greater part of the site of the Oxford Prison, including the Castle Mound, being made into a public park. In the western section a new joint railway station should replace the present inconvenient and unsightly structures. In the central section the covered market should be removed, and possibly two new markets substituted, one in Castle Street and the other in East Oxford. Gloucester Green might become a square for shops and offices, while Holywell with Merton Street should preserve its present character.

In regard to surrounding towns and villages, Kidlington should become more self-contained, with better shops and social amenities. A number of villages in the vicinity of Oxford should be protected from industrialization and objectionable building, but there are in the district country towns which might welcome the advent of new light industries. The beginning of a protective girdle of open land around Oxford already exists, but early action is necessary to protect from building development a number of farms and playing-fields on the fringe of existing suburbs, together with several stretches of hill and woodland. This will involve some purchase of land in the public interest, but much will continue in use for agriculture, including market gardening.

To relieve the congestion in the centre of the city, it is essential to complete the northern and southern by-passes at the earliest date possible after the War. The northern section of an inner circular road which has also been under consideration by the City Council, with a new bridge over the Cherwell near the southern end of Mesopotamia Walk, would also be an advantage, but the difficult questions raised by the alignment of the southern section might be left for further consideration until the effect upon traffic of the various other measures contemplated becomes apparent. Other recommendations include a greater use of Cowley Station for passenger and goods traffic, doubling the single-track line to Princes Risborough, with an alternative fast railway service to London and elsewhere; provision of numerous public walks; improvements in the confused water-way system; proper control over the design of new or restored buildings, and the preservation of old houses remaining in the area of the medieval city; and adequate amenities, including a building for a proper health centre.

The post-war reconstruction of Liverpool was the subject of an address by Alderman A. E. Shennan, which has been published by the Liverpool Council of Social Service and the Merseyside Civic Society. The extensive damage which Liverpool has suffered from the numerous air raids has given it an opportunity of re-planning which it could not otherwise have hoped to see, and in commending Alderman Shennan's bold scheme, the Lord Mayor points out

¹ Bingham, Harold C., *Behav. Monogr.*, 4, No. 4, 1 (1922).

² Honigmann, H., *Biol. Rev.*, 17, No. 4 (1942).

³ Bierens de Haan, J. A., "Animal Psychology for Biologists" (London, 1929).

⁴ Russell, E. S., "The Behaviour of Animals" (London, 1934).

⁵ Bierens de Haan, J. A., *Biol. Zbl.*, 45, 727 (1925).

⁶ Breed, Frederick S., *Behav. Monogr.*, 1, No. 2, 1 (1911).

⁷ Köhler, W., *Abh. Preuss. Akad. Wiss., Phys.-Math. Kl.*, 1 (1918).

in a foreword that it provides a plan of central Liverpool which would make it a place worthy of the coming needs of post-war building on a grand scale. The broad street or avenue making a circuit from pier-head to pier-head, connecting the three railway stations and forming a ring from which traffic could easily move to the outskirts without crowding the centre as at present, would give an importance to the inner section of the City which it sadly lacks to-day. Moreover, the re-planning of the pier-head itself would give Liverpool at last a water-front of which it might be proud, and through which it would proudly welcome travellers from all parts of the globe.

The first proposal covers the dock area, whereby the Dock Road, north of its junction with King Edward Street, would virtually become a private service road on a combined dock and railway estate, extending the existing dock estate eastwards to Derby Road and Great Howard Street. These two roads would be converted into a wide artery capable of carrying all north- and south-bound through traffic along the line of the North Docks, and the Overhead Railway would be replaced by a more mobile system of passenger traffic.

A major item in the plan is an inner ring road which is regarded as the proposal which could confer the greatest benefit to the heart of Liverpool. It is a feature missing in the natural development of most towns. It would give added importance to Exchange Station, and the scope for architectural treatment which the expansion of the railway termini afford is greatly stressed by Alderman Shennan. There would be a direct connexion between Exchange Station and the Lord Street-Church Street shopping centre, while the proposals for the new civic centre, the heart of which is the tunnel entrance, provide for the reservation of the St. John's Lane frontage for civic buildings, to balance the Museum and Art Gallery, and to complete the growing of the stately beauty of St. George's Hall, while on the western side, buildings connected with the administration of the City would be sited.

The town hall, the two cathedrals and the pier-head are the subject of other planning proposals, and the scheme contemplates a general rectification of the existing street plan, control by zoning, provision of industrial sites, open spaces and linking the parks. The plan involves a long-term as well as a short-term policy.

There is no reason to doubt the ability of the people of Great Britain to seize the opportunities of re-planning which the War has given us, and these two examples of plans show a vision and vigour which are the best safeguard against the apathy and selfishness which led to London missing its opportunity of nearly three centuries ago.

ELECTRICAL PRODUCTION OF BULLET-PROOF STEEL

THE manufacture of bullet-proof steel is surveyed in an article by A. G. Arend in the *Electrician* of July 31. Formerly intended for helmets, bullet-proof steel was also made for breastplates in the closing stages of the War of 1914-18. When the latter were first proposed, a manganese-vanadium steel was employed containing some 0.90 per cent of man-

ganese and 0.20 per cent of vanadium, and was prepared in Heroult three-phase electric furnaces. Despite the purest possible metal being produced, results were not uniform, and a manganese steel was substituted containing 12 per cent of manganese, and 1 per cent of carbon.

Little has been done in the intervening years in the way of development, although vanadium steels have found extended use in automobile production. A maximum of 0.02 per cent is allowed for both sulphur and phosphorus; the small range of the other constituents precludes the use of anything but the absolute precision of control peculiar to the electric furnace. The vanadium constituent is important, and although ranging only from 0.15 to 0.25 per cent content, it allows of a light strong steel. The last approved bullet-proof steel, prepared in 6-ton Heroult furnaces, contained 2 per cent nickel, 1 per cent manganese, 0.20 per cent vanadium, 0.20 per cent silicon, 0.02 per cent phosphorus, 0.02 per cent sulphur and 0.42 per cent carbon. The admissible error was 0.05 per cent except with sulphur and phosphorus, which could not exceed the 0.02 per cent maximum.

The furnaces were not then equipped with automatic arc regulation, and gave trouble in the initial melting of scrap. Present-day furnaces are of smaller capacity and bottom connexions are omitted in the larger sizes to avoid the formation of cracks. Water cooling of bottom connexions, so far as the hearth is concerned, is now regarded as potentially dangerous.

There is a choice of design to-day between the direct arc and arc-resistance types of furnaces, the latter being preferred when a smaller charge suffices. Troubles with the smaller electrodes for 1-ton hearths resulted in the use of two-phase furnaces with bottom connexions, the current being supplied through Scott connected transformers. In comparison with the low operating voltages used for plain carbon steels, supply is usually switched on at 110 volts: with the cold scrap used in the charge, surging can momentarily raise the current as high as 10,000 amp. Since the refining period tends to vary, the energy consumption ranges from 750 to 825 kwh. per ton.

The carbon content following de-phosphorizing should be about 0.300 per cent, with the actual phosphorus below 0.02 per cent. Tapping temperature is important and after final additions have been made to the melt, it is only allowed to remain in the ladle long enough for the slag to rise properly, whereupon it is cast into ingots of about 8 in. by 14 in. cross-section, care being taken to avoid undue strains from shrinkage by chilling. Ingots are then rolled and shaped as required, undergoing any necessary heat treatment.

During 1914-18, two test methods were available for helmets and breastplates. The former, which were of 0.035 in. sheet, were subjected to the impact at 10 ft. of a bullet fired from a 0.44 Colt revolver with a muzzle velocity of 840 ft./sec. The breastplates, of 0.175 in. thickness, were expected to withstand the impact of a copper-sheathed rifle bullet fired at 50 yd. with a muzzle velocity of 2,140 ft./sec. In the former case the metal was considered to be satisfactory if the bullet did not make a dent of more than 0.5 in. in depth and 3.5 in. in diameter. Successful production of bullet-proof steel largely depends upon systematic furnace operation, and it is imperative that all electrical connexions function with precision to permit of continuous uniform working without temporary stoppages.