

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 15, 1886.

WASHINGTON'S SIGNATURE.

DR. PERSIFOR FRAZER recently published in the Proceedings of the American philosophical society a paper on composite photography as applied to handwriting. One of the most interesting results is that he obtained with the signature of Washington, the facsimiles of which we here reproduce. The difficulties of the process, and the peculiarities of composite signatures, were pointed out in *Science* of Jan. 22.

George Washington's signature was one of the first to suggest itself for the purpose, because many persons were familiar with it, and there are numerous well-authenticated documents in existence which bear it; but it has proved to possess other advantages which were not known when it was selected. As in every thing else, Washington was deliberate, painstaking, and uniform in his method of writing his signature, and the consequence is that it makes an excellent composite for illustration.

In writing his signature, Washington put pen to the paper five times. First he wrote the *G W* in one connected line. Second, he raised his hand and made the small *o* between the upper parts of the *G* and *W*, and the two dots which appear in all but signature No. 7. Third, his hand and arm were placed in position to write *ashing*, these six letters occupying a breadth of almost exactly $1\frac{1}{2}$ inches in every signature except the third, when they are extended to $1\frac{1}{8}$ inches. This is about as much of the arc of a circle (of which the centre is the elbow pivoted on the table) as one with a forearm of average length can cause to coincide with the tangent, or the straight line across the paper which the lower parts of the letters follow, unless unusual effort be made, and a great deal more movement be given to the fingers. The *g* ends in a curved flourish, of which the convex side is turned upwards below the right centre of the name. The lower loop of the *g* in all the signatures and in the composite was cut off in preparing the plate. Fourth, he wrote the final *ton*. Fifth, he added the very peculiar flourish above the right centre of the name, with the object of dotting the *i* and crossing the *t* at the same stroke.

In examining the composite, the effect of these various separate movements becomes manifest in its strengthened portions. It is hardly possible

that any one, during the period of sixteen years which these signatures represent, or from 1776 to 1792, should have so schooled his hand to write a long name that the first inch or so of the writing should always occupy the same relative position to the body of the signature. It would take at least that much action for the hand and arm and pen to be brought into normal signature-writing condition; and especially is this so when this part of the writing is accompanied by flourishes, as it is in the case we are considering. The *G W*, and the little *o*, and the dots at the top, were the prelude, after which the arm was moved into position to write the main body of the signature, or the *ashing*. Of course, from the manner of making the dots, and the extremely small space they cover, their re-enforcement of each other in the composite was almost impossible, and, in fact, like other subordinate characters, they disappear almost completely. This latter is the part of the name which one would have expected to exhibit the greatest amount of uniformity, as in point of fact it does, with the exception of its terminal *g*, which shows more variation than any of the other letters, because at this point the limit of coincidence between the tangent line of the writing and the curve, of which the right fore-arm was the radius, had been passed, and a freer movement of the fingers was compensating for the increasing divergence. It is likely that Washington sometimes raised the hand between the end of the long *s* and the beginning of *h*, but he does not appear to have moved the elbow. All but the second signature are consistent with this view, and in the first, third, and fifth it is plainly indicated. In the others, as in the flourish above the sixth signature, the pen may not have marked. The fourth separate act of the penman was the formation of the *ton* after a movement of the arm. The breadth of the space occupied by these three letters is from $\frac{3}{8}$ to $\frac{7}{8}$ of an inch, or considerably within the range of coincidence of the curve and straight line before referred to; and owing to this fact there is only a moderate degree of re-enforcement of the letters in the composite, because these letters might fall into the first or last parts of the 2-inch space which was the limit of movement with a fixed elbow. It is worthy of note that even in this case the middle letter of the three is darker in the composite than either of the outside letters. The fifth and last movement was the flourish which dots the *i* and crosses the *t* by one stroke. This was done in the freest of free

1 *G. Washington*

2 *G. Washington*

3 *G. Washington*

4 *G. Washington*

5 *G. Washington*

6 *G. Washington*

7 *G. Washington*

8 *G. Washington*

hands ; often, as it seems probable, without resting hand or arm on the table at all. Therefore there is no coincidence of the lines in this part of the composite, and the *region* of variation is wider than that of any other part of the signature.

All the signatures used in the accompanying plate (seven in number) are unquestionably genuine. With the exception of one, which is the property of Dr. Frazer, they were carefully chosen from a number of authenticated signatures in the possession of the Historical society of Pennsylvania.

No. 1 is on a letter dated Dec. 18, 1776, from near the Falls of Trenton, and addressed to Washington's brother Samuel.

No. 2 is on a letter dated Headquarters, Nov. 4, 1777, and is addressed to Lieut.-Col. Persifor Frazer, then a prisoner of war in Philadelphia.

No. 3 is on a letter dated Sept. 27, 1777, and is to William Henry of Lancaster.

No. 4 is the composite of all the rest.

No. 5 is on a letter dated Headquarters in Morristown, Feb. 22, 1777. The person to whom the letter was addressed is not stated.

No. 6, dated Sept. 26, 1793, is affixed to the commission of David Lenox.

No. 7, of the same date, is affixed to David Lenox's appointment as agent for the relief and protection of American seamen.

No. 8, dated May 24, 1799, closes a letter to Thomson Mason.

THE PSYCHOLOGY OF FEAR.

IF a true psychology is physiological, and if the physiological furniture of the world is largely the result of a vast series of experiments of which only the most successful ones have survived, it ought to be possible to find an important useful significance in the thought-habits, the instincts, the will-mechanisms, the emotions of animals, and more especially of man. It was this conviction that set Darwin to work on his 'Expression of the emotions in man and animals.' Among these emotions there is one, very wide-spread in the animal kingdom, as Dr. Romanes has shown ('Mental evolution in animals'), very important to the welfare of the animal, and typical of the suggestive conceptions resulting from the positing of a comparative and a physiological point of view, — the emotion of fear.

M. Charles Richet (*Revue de deux mondes*, July, 1886, pp. 73-118) considers it an apt time for presenting the subject in a popular manner ; and it may be equally worth while to give a short account of the scientific conception of fear, following in the main the article of M. Richet.

Emotions may be considered under two heads, according as they attract or repel the object by

which they are called up. The three chief emotions of the latter class are pain, disgust, and fear. Each of these emotions has a physical and a psychological aspect. We use the word 'pain' to mean the sensation resulting from a cut finger, and the emotion caused by the death of a friend. We can be disgusted by a nauseous concoction, and also morally disgusted at the mean conduct of a supposed friend. There is the paralyzing effect caused by the sudden appearance of a lion, and the dread of a coming examination. As in the other emotions connected with a definite disturbance of the nervous system, there appear in the animal scale and in human development all shades, from the simplest physical reflex to the most elaborated, consciously willed action. But the emotion itself — the fear — can be readily detected in all these varying modes of expression.

Repelling emotions are protective in their function. Pain gives us tidings of the condition of the organism, and thus demands the needed remedy, and averts injury. Disgust warns us of noxious substances. The object of fear is to advertise and escape danger to life. It would not do to leave the danger to be avoided by a reasoned action : there would be no time to form syllogisms. Nature puts the emotion first, and the reasoning afterwards. The chickens would soon disappear if they had not an instinctive fear of the fox. There is, then, a simple form of the emotion which expresses itself by an unreasoned, involuntary reflex action. These effects are well shown by the typical picture of terror, — the pale features, the limbs fixed powerless to move, trembling, chattering of teeth, altered heart-beat, gasping breath, cold perspiration, etc. These paralyzing effects of fear may reach a dangerous intensity, and produce death by arresting the activity of the heart. The story told by Dr. Lauder Brunton, of an instructor who had made himself obnoxious to the college students, and, after being blindfolded, was subjected by them to a process imitating death by decapitation, and found to be really frightened to death, is a case in point. It is said that condemned criminals are often nearly dead with fright before the instrument of death is applied. These physical effects of fear are best seen in the lower animals. The fear most commonly felt by us shows itself in what may be called a psychic reflex. In this case the sense stimulus is interpreted, and then the reflex expression of fear follows. If during a performance the rope of a trapeze breaks, the sensations by which that fact is made known are at once interpreted as a threatening danger, and by the force of sympathy fear will possess the spectators as well as the performer. Of course, this is not a natural stimulus.