

Italian is contemporary with Latin as far as it is only a corrupted Latin. The corruption of Latin can be traced to the time of Tacitus and Seneca, that is to say, to the first century of the Christian era, when the barbarians had not yet invaded Italy. The translation of the Bible made at that time for the people, and revised afterwards by St. Jerome in the time of the Empire, and always, for the multitude, is the most important proof of this corruption. There we find the use of articles and prepositions, or signs of the cases for the first time. There we find Italian idioms, which are still the same. This corruption was, of course, continued and accelerated by foreign invasions, by the absence of a national literature, by centuries of popular ignorance and want of political existence, and by loose grammar; causes which even in our day would all lead to the same result.

We see then by this review of the principal features of the long and laborious intellectual revolution which took place in Italy between the Roman decline and the Italian revival, that the first and most important fact which transforms civilization, is the intro-

duction of Christianity into Rome, the great centre of the ancient Pagan world.

A second and also important event is that of foreign invasions, which more or less contribute to quicken a revival of art, science, and literature, and the influence of which originates in the courts, whence they spread to the nation.

A third and equally important fact is that of the political, artistic and literary traditions of Rome, which are still retained by the bulk of the nation, and like a smouldering fire only wait the opportunity to break out; and they do in fact revive in the Italian Republics, and create the most splendid period of Italian history, which is also the golden era of Italian literature and art.

These three facts, influencing in different degrees, Italian art and literature before Giotto, and Dante, bring us naturally to the division of the three following Lectures, to which the present is but an introduction. That is to say, art, and literature in relation—

1st, To Religious Life;

2nd, To Court Life;

3rd, To National Life.

EDOARDO FUSCO.

*To be continued.*

## GAMES AT CARDS PLAYED BY MACHINERY.

DEAR MR. EDITOR,—I am much flattered by your request that I would send you another Card Article for your Christmas Number; but I fear I have almost exhausted the range of the subject. I have written on games of cards which may be played by a room-full of people (January, 1870); on games for four players (December 1861, January 1863); on games for three players (January 1873); on games for two players (December 1861); and last January you did me the honour to insert an article on games at cards for a single player. It would seem difficult to go on to games not played at all; but there is something like an approach to them in an invention lately put before the world, namely, games at cards played by machinery. I need hardly say I allude to the wonderful automaton, exhibited by Messrs. Maskelyne and Cooke, at the Egyptian Hall, Piccadilly. This ingenious mechanical figure at present plays whist, and plays it well; but it would play picquet, cribbage, écarté, or almost any ordinary card game with equal facility and success. In default of a better subject I propose to give your Christmas readers some account of this singular novelty.

The proprietors of the figure are something more than mere exhibitors of the art of *legerdemain*, for they have for some years past attracted interest by novel and startling contrivances which have involved ingenious applications of physical science, and which, if their explanation had become generally known, would have secured a more honourable appreciation than the blind admiration of the wondering crowd.

Some time ago, acting on a hint given them by a friend, these gentlemen conceived the idea of making an auto-

maton figure which should, without any apparent human agency, perform feats exhibiting intelligence and volition; they spent two years in the manufacture, and the result was the production of "Psycho," who has been now before the public for about twelve months, attracting crowds of visitors, and exciting great wonder and curiosity.

Psycho is a figure a little less than adult size, who sits cross-legged in Oriental fashion, on an oblong box, resembling one of the hand organs carried about the streets. The dimensions of the box are, judging by the eye, about twenty-two inches long by eighteen inches wide, and fifteen inches high, and from the top of the box to the crown of the figure's head may be between two and three feet.

The box, with the figure on it, is entirely detached, and is carried about by Mr. Maskelyne and an assistant. When in action it is placed on the top of a strong hollow cylinder of transparent glass, about ten inches diameter and eighteen inches high. This cylinder rests on a loose wooden platform about four feet square, which again is supported at a distance of about nine inches clear above the floor of the stage by four short legs, one at each corner.

When Psycho performs his intelligent feats, both his arms move, in a way to be hereafter described, and he also shakes his head; but as this shake has not the tremendous significance of Lord Burleigh's, we may ignore it in our present description.

Before commencing the performance, the foundation platform is lifted up, turned about, and exhibited to the audience, before being placed in position. The glass cylinder is then handed round to the spectators, who may satisfy themselves it is nothing but

what it professes to be, and has no concealed contrivance about it. It is then placed upright on the platform, and Psycho and his box are put loosely upon its upper end. Mr. Maskelyne invites upon the stage any of the spectators who may wish to examine the apparatus more closely. Several parts of the figure are uncovered and exposed, and doors are opened at the end of the box, a long stick being passed completely through, to show that nothing of any large size can be concealed within. At the same time, persons are requested to walk completely round the figure and to pass their hands over his head, to satisfy themselves that there is no wire or other means of communication between the figure and the sides or ceiling of the room; while the transparency of the glass cylinder, and the detached position of the platform above the floor, forbid the supposition of any mechanical connection in a downward direction. Altogether the perfect isolation of the figure is guaranteed by the most unquestionable evidence.

The performance begins by Mr. Maskelyne declaring Psycho's ability to perform arithmetical calculations. Two numbers are chosen by the audience, Psycho is requested to multiply them together, and he then by a motion of his left hand causes to appear successively on a small tablet the several digits of the product. Other arithmetical operations, such as dividing, squaring, and cubing, are performed in a similar way. I asked him on one occasion for the cube of 12, and the figures 1, 7, 2, 8, were immediately shown.

Then comes the great feature of the evening, the hand at *whist*. A table is prepared on the stage, three persons from the audience are invited to play, and Psycho makes the fourth. After cutting for partners, the deal takes place, and Psycho's cards are taken up by Mr. Maskelyne, and placed upright, one by one, in a frame forming the arc of a circle in front of the figure; the faces of the cards being turned towards him and away from the other players. When

it is Psycho's turn to play, his right hand passes with a horizontal circular motion over the frame till it arrives at the right card; he then takes this card between his thumb and fingers, and by a new vertical movement of the hand and arm, he extracts it from its place, lifts it high in the air, and exposes it to the view of the audience; after which, the arm descending again, the card is taken away from the fingers by Mr. Maskelyne, and thrown on the table to be gathered into the trick.

The play of one whist-hand suffices to exhibit the skill of the automaton; and he concludes his performance by a few tricks of conjuring—such as extracting a certain card from the pack when placed in a box—striking on a hand-bell to answer questions and to indicate drawn cards, and so on.

We may confine attention to the whist-play, and it will be well at once to dissipate any notions about confederacy, packed cards, and so on. There is conclusive evidence that the play is perfectly *bona fide*. Any person may join in it, the process is precisely of the usual character, and it is certain that Psycho's hand is played under the same circumstances as that of any player at a club or at a domestic fireside. He is said to play very well, and to understand perfectly what I have called in my little book "The Modern Scientific Game." I may give an example of a hand, offering some interest, which I saw played about a month ago. I will call the three human players A, B, and C, B being Psycho's partner. B had the deal, turning up the 7 of clubs, and the cards dealt were:—

## A's HAND.

Clubs . . . Ace, Nine, Two.  
Hearts . . . Ace, Knave.  
Spades . . . Queen, Ten, Four, Three.  
Diamonds . . . Ace, King, Ten, Eight.

## B's HAND.

Clubs . . . Seven, Six, Five, Four.  
Hearts . . . Ten, Four.  
Spades . . . Knave, Six, Five, Two.  
Diamonds . . . Nine, Five, Three.

## C's HAND.

Clubs . . . Ten.  
Hearts . . . Eight, Six, Three, Two.  
Spades . . . Ace, King, Nine, Eight, Seven.  
Diamonds . . . Queen, Seven, Six.

## PSYCHO'S HAND.

Clubs . . . King, Queen, Knave, Eight, Three.  
Hearts . . . King, Queen, Nine, Seven, Five.  
Diamonds . . . Knave, Four, Two.

The play was as follows; the winner of each trick being marked by an asterisk—

TRICK.	PLAY.
I. . .	C . . . Ace of Spades. *Psycho . . . Three of Clubs. A . . . Three of Spades. B . . . Two of Spades.
II. . .	Psycho . . . King of Hearts. *A . . . Ace of Hearts. B . . . Four of Hearts. C . . . Two of Hearts.
III. . .	*A . . . King of Diamonds. B . . . Three of Diamonds. C . . . Six of Diamonds. Psycho . . . Two of Diamonds.
IV. . .	*A . . . Ace of Diamonds. B . . . Five of Diamonds. C . . . Seven of Diamonds. Psycho . . . Four of Diamonds.
V. . .	A . . . Eight of Diamonds. B . . . Nine of Diamonds. *C . . . Queen of Diamonds. Psycho . . . Knave of Diamonds.
VI. . .	C . . . Ten of Clubs. Psycho . . . Knave of Clubs. *A . . . Ace of Clubs. B . . . Four of Clubs.
VII. . .	A . . . Nine of Clubs. B . . . Five of Clubs. C . . . Three of Hearts. *Psycho . . . Queen of Clubs.
VIII. . .	*Psycho . . . King of Clubs. A . . . Two of Clubs. B . . . Six of Clubs. C . . . Seven of Spades.
IX. . .	*Psycho . . . Queen of Hearts. A . . . Knave of Hearts. B . . . Ten of Hearts. C . . . Six of Hearts.
X. . .	Psycho . . . Nine of Hearts. A . . . Ten of Diamonds. *B . . . Seven of Clubs. C . . . Eight of Hearts.
XI. . .	B . . . Five of Spades. C . . . King of Spades. *Psycho . . . Eight of Clubs. A . . . Four of Spades.
XII. . .	*Psycho . . . Seven of Hearts.
XIII. . .	*Psycho . . . Five of Hearts.

—the result being that Psycho and his partner score two by cards and two by honours.

Psycho's play was evidently dictated by judgment and principle. Having been forced to trump the first trick, he abstained from leading trumps till he had done something towards clearing his long heart suit, and he was afterwards favoured by his opponent A., who fell into the very common blunder of leading trumps when weak, for the insufficient reason of his suit being ruffed; his lead of clubs at Trick VI. was just what Psycho wanted, and the latter accordingly followed it up till his opponents were disarmed. His partner afterwards did his best to thwart him in Trick X. by trumping his best heart, and so stopping his suit, but Psycho was fortunately able to regain the lead, and so to bring in his remaining long cards.

There can, I repeat, be no doubt whatever of the genuineness of the play; and I confess that to me, standing beside this little wooden doll, apparently isolated from any human agency, and seeing it not only imitate human motions, but exert human intelligence and skill, the effect seemed weird and uncanny; and I could hardly wonder at the Spiritualists, who seriously conjecture that Psycho may be one of the manifestations comprised in their own Psychological creed.

However, we may dismiss such fanciful notions, and may take it for granted that the automaton is actuated by purely mundane forces, and we come now to the question, How is it done? Mr. Maskelyne throws down the gauntlet to the world, challenging them to discover his secret if they can, and I confess it is a very pretty scientific and mechanical problem. It will be worth while to review the various modes by which the solution may be possible, and to consider which of them is the most likely to be the correct one.

The most obvious suggestion is that a human being may be concealed inside the figure. This, as the exhibitor reminds his audience, was the explanation of the celebrated automaton chess-

player, produced by De Kempelen many years ago. In this case there is very little room indeed, but it is said a small child would suffice to obey signals conveyed to him from outside. For my part, after looking at the figure as opened, I have no hesitation in accepting Mr. Maskelyne's assurance that there is not available space even for this; and, moreover, it appears to me that the character of the motions is such as to reveal clearly to a mechanically-educated eye that they are produced by mechanism, and not by direct muscular action.

The idea of transmission of motion by wires or connections, either for mechanical action or for the conduction of electricity, is negatived by the opportunity for thorough inspection all round the figure, above, at the sides, and underneath; and failing this, suggestions have been made of forces which will act at a distance. Magnetism, for example, will influence a needle a good way off; as is instanced every day by the aberration of ships' compasses, owing to masses of iron in the hull or interior of the vessel. Heat also will radiate to long distances, as is shown in the well-known experiment of lighting a match by heat caused to converge upon it from a hot body on the other side of the room. It might, perhaps, be possible to produce some mechanical effects on the figure in either of these ways; but when it was attempted to work out in detail either of these suggestions, I fear the difficulties of accounting for the motions actually produced would be very great, if not insurmountable.

There remains another possible solution which appears to me very much simpler, easier, and more satisfactory. Whether it is the correct one or not, I will not venture to say, for the proprietors naturally disguise or conceal with much care all the weak points which would lead to detection. I will endeavour, however, to show that this plan is consistent with all the facts and appearances, so far as they are visible to the outside observer; that it

is easy of construction and working, and that it will account for everything that is done.

On this view, the secret is that, although there is no *visible* mechanical communication between the automaton and any human agency, there is such a communication in an *invisible* form, namely in the form of a *column of air*, extending from the lower part of the box, through the glass cylinder, and certain openings below it, to some place either below the stage or behind the scenes. It is well known, according to the laws of pneumatics, that if we have a closed space, filled with an elastic fluid, and an alteration of the density of the fluid be effected at any one point, that alteration will be quickly distributed over the whole contents. And, since the pressure varies with the density, if by any artificial means we exercise a compressing or exhausting action at one end of a column of air, that action is immediately transferred to the other end of the column in the shape of an increase or diminution of pressure, which is capable of producing mechanical action. Hence, supposing a column of air to extend from the figure to some place behind the scenes, the air in the column may be operated on at that place at any given moment, and the effect of such operation will be at once to communicate the power of motion to some part of the figure.

It is curious how the invisibility of the atmosphere around us deadens our appreciation of the fact that air is really a material substance, endowed with physical and mechanical properties as positive as those of water or mercury. We see, every day, follies committed in pneumatic arrangements which are incomprehensible except on the supposition that the authors of them have treated air as a sort of transcendental ether, without any real entity, or any of the commonplace qualities of ponderable matter. The usual arrangements for what is called, by an amiable courtesy, "ventilation," are generally striking examples of this. Take, as a most notorious instance, those of our

chief metropolitan concert hall. The builders have been at great trouble and expense to make copious provisions for the air to *get out*, but they have unluckily forgotten to make any corresponding provisions for other air to *get in* to supply its place. Consequently, on the ancient principle that "nature abhors a vacuum," the "ventilation" of course refuses to work, and the atmosphere, during a well-attended evening concert, is like the Black Hole of Calcutta, until the lower doors are opened, when the fierce natural effort of the air to rush in and remedy the blunder of the designers gives all the people around bronchitis and rheumatism. A certain ventilation doctor has lately acquired fame by simply having common sense enough to perceive, what architects in general do not perceive, that air requires be treated on the same laws as matter in general. I must apologize for this digression, but it illustrates the singular illusions which may attend the mechanical action of an invisible fluid, and may serve to explain how, if this be Psycho's secret, it may have so long escaped detection by general observers.

The idea of transmitting power to a distance by means of air is by no means new. It was first suggested by the celebrated Denys Papin, the person who has, in my opinion, a good claim to the title of the first inventor of the steam-engine. In 1688 he described<sup>1</sup> an apparatus in which a partial vacuum produced in a long tube by air-pumps fixed at one end, caused the motion of pistons placed at the other end. One of our most eminent writers on mechanics, speaking of this scheme about half a century ago, says:—"It is rather surprising that so simple and advantageous a method of exerting power at a distance from the first mover, should have remained neglected and unnoticed so long." The principle has, however, been more attended to of late; it formed the basis of the well-known atmospheric railway, which made such a sensation from 1840 to 1848; and those who are acquainted with modern tele-

<sup>1</sup> Acta Eruditorum, Lipsic, 1690.

graph engineering, know that there are miles of air-tubes now laid along the streets of London, Paris, Berlin, and Vienna, to effect motion by pneumatic power. While writing this article, I have received a prospectus of a "Pneumatic Despatch System of Domestic Telegraphs," for the purpose of sending messages in this way from the dining-room to the kitchen, or from the drawing-room to the stables. One of the most striking and elegant applications of the system is at Schaffhausen, where a large amount of power obtained from the river Rhine is caused to be utilized in the city, some mile or two away, by the medium of air-tubes.

If, therefore, Messrs. Maskelyne and Cook adopt this system, they are in good company. It remains to explain how it is, or at least might be, applied.

The glass cylinder is ground smooth on its two ends, and if these ends are applied against the surface of some soft material, they will, when the weight comes upon them, form joints at the top and bottom sufficiently air-tight for the object in view. To indicate how the air passage is continued further downwards is not so easy, seeing that it must pass through the movable platform on which the glass stands. I confess that this part of the contrivance is concealed with consummate skill; but I think there is a possible way out of the difficulty.

If the upper surface of the platform were of uncovered wood, in which no opening was visible, one would hardly see how the thing could be done; but this is not so. The boarding is covered with soft baize, and there is no reason why the part within the cylinder may not have holes covered by the baize, through the pores of which the air would pass freely. From these holes a small channel may exist through the body of the wood, passing either down one of the legs or out at the back, and so continued by a pipe to the operator. When the platform is turned about and shown to the audience, the communicating hole may be concealed, and the connection may be made when the



platform is in place, either from below or behind. Supposing this done, the necessary air column is established between the operator behind the scenes and the bottom of Psycho's box, and we have next to consider how this is to be utilized.

The air may be operated on in two ways, both in common use; one called the *plenum* action, by compressing the air; the other the *vacuum* action, by exhausting or expanding it. These actions may be effected by several mechanical modes:—if a large difference of pressure is required the most prompt way is to have at hand two reservoirs, one of compressed, the other of expanded air, and to open communications with them by cocks, which would instantly induce the corresponding action in the tube. But probably for the present purpose the alteration of pressure need only be slight, and might be effected, either way, by a simple bellows or analogous contrivance. Or possibly a simpler mode still, the action of the breath, in alternative blowing and sucking, might be made available.<sup>1</sup> A clever mechanic, like Mr. Maskelyne would have no difficulty in designing a simple contrivance, easily under the hand of the operator, by which the air in the tube could be either compressed or expanded at pleasure, and regulated with the greatest nicety.

We have then only to suppose two pistons, or diaphragms, or other equivalent apparatus, within the figure box, connected with the interior of the glass cylinder and properly adjusted, and the whole is in order. On applying the *plenum* impulse behind the stage one of the pistons in the figure would be caused to move; on applying the *vacuum* impulse the other piston would be caused to move, and thus the hidden operator would command two separate influences at pleasure.

And, going a step further, we shall see that these two distinct influences are exactly what are required to effect

Psycho's whist playing. He does two things, and only two; one consists of a horizontal movement of the arm to choose the card, the other consists of a vertical movement of the arm to raise the card in the air.

The horizontal action is arranged with peculiar ingenuity. There is a clock-work motion, which if acting freely would cause the figure's hand to travel backwards and forwards over the 13 cards; this action can be checked at any given point, probably by the action of a break, or a detent stopping the fly vane, as in a musical-box. If we suppose this check to be worked, say by the *plenum* piston, the operator has only to exert his *plenum* action and lift off the check, when the hand will slowly move by the clock-work influence, and when it arrives at the proper card the stopping of the influence will put the check in action again and stop the further progress.

The operator then changes to the *vacuum* action, setting in motion the vacuum piston within the figure, and it is clear that by proper machinery this may be made to raise Psycho's arm, which is the second thing to be done. By delicate manipulation the arm may be made at will to rise, to fall, or to stand still in any position, effects which Mr. Maskelyne exhibits with very proper pride.

Thus the whole problem of the whist-playing may be accounted for. Whether the real player is Mr. Maskelyne, who remains on the stage and signals to his assistant behind, or whether it is the operator himself, who has some means of knowing the cards, I do not pretend to say, but this is of little consequence; the only important thing is to discover how the will and intention of the operator can be made to work the figure. I have, of course, only indicated the salient points of the hypothesis, omitting the details, which an expert mechanic like Mr. Maskelyne would easily apply.

The arithmetical trick is explained in a similar way, namely, by a dual movement; the digital figures are caused to revolve by clock-work, which is stopped by the *plenum* check when the right

figure comes to the right place; and then the vacuum movement causes the motion of the figure's left arm, which exhibits the digit to the audience. The transfer of the pneumatic actions from the whist-playing to the arithmetical machinery, and *vice versa*, may be easily managed.

The conjuring tricks involve no motions beyond what have been described.

If the foregoing explanation be the true one, then I heartily endorse the statement Mr. Maskelyne publicly makes, that "if the secret should be discovered, it will not detract from the merit of the construction." So far from it, I say he becomes, by the discovery, entitled to a much more worthy and discriminating praise for the skill and knowledge he has shown, and I do not think it likely that the publication will be likely to diminish his more substantial reward. If, on the other hand, my suggestion does not apply, then he has a store of ingenuity yet unappreciated, and I must take the merit to myself of inventing, *de novo*, another card-playing automaton, competent to do all that Psycho does, and under the same conditions, so far as they are at present visible.

There is another very pretty and ingenious feature in the exhibition, which I should like to mention, that is the *animated tambourine*. An assistant brings out, during the performance, a little loose table, with a round top about a foot in diameter, and sets it down in the middle of the room among the audience. He then places on it a tambourine, also perfectly loose, and obviously without

any connection either with the table or elsewhere. It is further quite clear that there is no pin or other moving part projecting above the table. Yet no sooner is the instrument placed on the table than it becomes endowed with animation and intelligence. It answers by shakes when spoken to, and it applauds vigorously when anything clever is done. The secret of this is, I presume, that there are two electric magnets concealed on two opposite sides of the table, and connected by wires to some distant place where they can be thrown rapidly in and out of circuit in the usual way; these magnets attract pieces of soft iron in the tambourine, which is formed slightly convex on its under side; and the rapid alternation of the two magnetic actions, gives the shaking effect observed. In setting the loose table in its place, the wires are no doubt thrown into connection by dipping into little cups of mercury. This clever device hardly receives the attention it deserves, for it ought to appear a most astounding wonder to those who do not know its scientific rationale.

It would be well, I think, if Messrs. Maskelyne and Cooke would give up the "spiritualistic" nonsense, which at present occupies so much of their evening. It means nothing; the darkness is objectionable on many grounds, and it does not do justice to the talents which they might exhibit more favourably in other ways.

I am, dear Mr. Editor,  
Yours faithfully,

W P.

<sup>1</sup> A tolerably strong man may produce, with his breath, a pressure of about 2 lbs. to the square inch, or an exhaustion of about 1½ lbs.