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On the 20th day of July was published, the SUPPLEMENTARY NUMBER *to the Seventh Volume of the* MONTHLY MAGAZINE, *containing—A comprehenſive Retroſpect of the Progreſs of* BRITISH LITERATURE *during the laſt ſix Months—and ſimilar Retroſpects of* GERMAN, FRENCH, *and* SPANISH LITERATURE; *with* INDEXES, TITLE, &c.

ORIGINAL COMMUNICATIONS.

For the Monthly Magazine.

EXPERIMENTS ON COLOURS.

IF a ray of light paſs through a glaſs priſm, it forms a ſpectrum; which, Sir Iſaac Newton conceives, may be compoſed of the following ſeven colours; viz. 1ſt, violet; 2d, indigo; 3d, blue; 4th, green; 5th, yellow; 6th, orange; 7th, red. If this ſpectrum be divided into 360 equal parts, each of theſe colours (according to Sir Iſaac Newton) will occupy that proportion of parts which is aſſigned to it in the circular ſpectrum. *See Fig.* 1. And if theſe colours be mixed, by making the circle revolve ſwiftly round its centre, they compoſe white.

It is generally known that indigo and red, when mixed in proper proportions, produce violet; that blue, and yellow, produce green; and that yellow, and red, produce orange.

Does it not then ſeem probable, ſince indigo, blue, yellow, and red, are capable of producing the other three colours, viz. violet, green, and orange, *that indigo, blue, yellow, and red*, may be the only original, or elementary colours, at leaſt that, *if mixed in due proportions, they ſhould produce the effect of the ſeven, or compoſe white.*

EXPERIMENT I. See Table, Fig. 2, A. 1.

To aſcertain upon this ſuppoſition the proportion of indigo, blue, yellow, and red, in white.

See the ſpectrum for the following proportions, viz.

		The Degrees in a Circle.	The Colours in the Spectrum.	Colours in the Circle which is to contain the four Colours.	
Indigo	40				
Blue	60				
Yellow	48				
Red	45				
			Indigo.		
As	193	360	40	74 $\frac{118}{193}$	Indigo
			Blue		
	193	360	60	111 $\frac{177}{193}$	Blue
			Yellow		
	193	360	48	89 $\frac{103}{193}$	Yellow
			Red		
	193	360	45	83 $\frac{181}{193}$	Red.
			360		

A circle then painted 74 $\frac{118}{193}$ indigo, 111 $\frac{177}{193}$ blue, 89 $\frac{103}{193}$ yellow, 83 $\frac{181}{193}$ red, ſhould produce white.

[*In future I ſhall not ſtate the proceſs for diſcovering the proper proportions of the different colours, but merely ſtate the reſults, for the ſake of brevity, and, for the ſame reaſon, I ſhall occaſionally uſe the initial letters of the colours only.*]

But it is contended, that although a violet may be produced, by blending red, and indigo; a green, by blending blue, and yellow; and an orange, by blending yellow, and red: yet the violet, green, and orange ſo produced, are *factitious* and *combined*, and not like the violet, orange, and green, priſmatic colours, becauſe if theſe colours, ſo compoſed, be paſſed through a ſecond priſm, they will be ſeparated into the two elementary colours compoſing them; which, it is ſaid, cannot be done with the priſmatic violet, green, and orange. Now Experiment A 1, and the conſideration, that the factitious violet, green, and orange, are each compoſed of the colours immediately contiguous to them, the one to the right hand, and the other to the left hand, in the priſmatic ſpectrum; as well as the objection mentioned before, (which, if it be concluſive, proves all the ſeven colours of the priſm to be equally elements), theſe circumſtances concur in ſuggeſting a ſuppoſition; *that any factitious priſmatic colour, may be produced by the two immediately contiguous.*

EXPERIMENT II.

Upon this ſuppoſition a circle painted,

45 or 190 $\frac{50}{85}$ Red
40 169 $\frac{35}{85}$ Indigo

Should compoſe 360 Violet.
See Table B 1.

EXPERIMENT III.

80 or 205 $\frac{100}{140}$ Violet
60 154 $\frac{40}{140}$ Blue

Should compoſe 360 Indigo.
See Table B 2.

EXPERIMENT IV.

40 or	144	Indigo
60	216	Green
Should compoſe 360		Blue.

See Table B 3.

EXPERIMENT V.

60 or	200	Blue
48	160	Yellow
Should compoſe 360		Green.

See Table B 4.

EXPERIMENT VI.

60 or	248 $\frac{24}{87}$	Green
27 or	111 $\frac{63}{87}$	Orange
Should compoſe 360		Yellow.

See Table B 5.

EXPERIMENT VII.

48 or	185 $\frac{75}{93}$	Yellow
45	174 $\frac{18}{93}$	Red
Should compoſe 360		Orange.

See Table B 6.

EXPERIMENT VIII.

27 or	90 $\frac{90}{107}$	Orange
80	269 $\frac{17}{107}$	Violet
Should compoſe 360		Red.

See Table B 7.

From theſe Experiments, B 1, to B 7, it appears that a factitious colour, reſembling any colour in the priſm, may be produced by the combination of the two that are immediately contiguous, in the proportion in which they are in the ſpectrum.

It follows then, that any three following colours in the ſpectrum when combined, produce only the middle colour, becauſe the two extremes produce only the intermediate colour.

EXPERIMENT IX.

45 or	98 $\frac{30}{165}$	Red
80	174 $\frac{90}{165}$	Violet
40	87 $\frac{45}{165}$	Indigo
Should compoſe 360		Violet.

See Table C 1.

EXPERIMENT X.

80 or	160	Violet
40	80	Indigo
60	120	Blue
Should compoſe 360		Indigo.

See Table C 2.

EXPERIMENT XI.

40 or	90	Indigo
60	135	Blue
60	135	Green
Should compoſe 360		Blue.

See Table C 3.

EXPERIMENT XII.

60 or	128 $\frac{96}{168}$	Blue
60	128 $\frac{96}{168}$	Green
48	102 $\frac{44}{168}$	Yellow
Should compoſe 360		Green.

See Table C 4.

EXPERIMENT XIII.

60 or	160	Green
48	128	Yellow
27	72	Orange
Should compoſe 360		Yellow.

See Table C 5.

EXPERIMENT XIV.

48 or	144	Yellow
27	81	Orange
45	135	Red
Should compoſe 360		Orange.

See Table C 6.

EXPERIMENT XV.

27 or	63 $\frac{144}{152}$	Orange
45	106 $\frac{88}{152}$	Red
80	189 $\frac{72}{152}$	Violet
Should compoſe 360		Red.

See Table C 7.

From the Experiments B 1 to B 7, which prove that any intermediate factitious priſmatic colour, may be compoſed of the two immediately contiguous, it follows: *that if any four following colours in the ſpectrum be taken, a tint or ſhade intermediate to the ſecond and third colours will be produced.* For the 1ſt, and the 3d, produce the 2d, which is intermediate; and the 2d, and 4th, produce the 3d, which is intermediate to them; conſequently the tint, ſhade, or colour, produced by all the four, will be the ſame, as would have been produced by combining only the 2d, and 3d, or the two intermediate colours.

From the Experiments C 1 to C 7, it may be inferred, *that white or the ſame effect which is produced by the combination of the ſeven colours, will be produced by beginning with any colour in the ſpectrum, and combining a quantity of the 2d colour equal to the 1ſt, 2d, and third; with a quantity of the 5th colour equal to the 4th, 5th, and 6th, and by adding to theſe the 7th colour*

colour in the proportion in which it exists in the spectrum, because any three following colours produce on combination only the middle colour. On this supposition white is produced by

EXPERIMENT XVI.

Indigo	180	= Violet 80 + Indigo 40 + Blue 60.	See C 2.
Yellow	135	= Green 60 + Yellow 48 + Orange 27.	See C 5.
Red	45	= Red 45 in the Spectrum.	
	360	See Table D 1.	

EXPERIMENT XVII.

Blue	160	= Indigo 40 + Blue + 60 Green + 60.	See C 3.
Orange	120	= Yellow 48 + Orange 27 + Red + 45.	See C 6.
Violet	80	See the Spectrum.	
	360	See Table D 2.	

EXPERIMENT XVIII.

Green	168	= Blue 60 + Green 60 + Yellow 48.	See C 4.
Red	152	= Orange 27 + Red 45 + Violet 80.	See C 7.
Indigo	40	See the Spectrum.	
	360	See Table D 3.	

EXPERIMENT XIX.

Yellow	135	= Green 60 + Yellow 48 + Orange 27.	See C 5.
Violet	165	= Red 45 + Violet 80 + Indigo 40.	See C. 1.
Blue	60	= See the Spectrum.	
	360	See Table D 4.	

EXPERIMENT XX.

Orange	120	= Yellow 48 + Orange 27 + Red 45.	See C 6.
Indigo	180	= Violet 80 + Indigo 40 + Blue 60.	See C 2.
Green	60	= See the Spectrum.	
	360	See Table D 5.	

EXPERIMENT XXI.

Red	152	= Orange 27 + Red 45 + Violet 80.	See C 7.
Blue	160	= Indigo 40 + Blue 60 + Green 60.	See C 3.
Yellow	48	= See the Spectrum.	
	360	See Table D 6.	

EXPERIMENT XXII.

Violet	165	= Red 45 + Violet 80 + Indigo 40.	See C 1.
Green	168	= Blue 60 + Green 60 + Yellow 48.	See C 4.
Orange	27	= See the Spectrum.	
	360	See Table D 7.	

It follows from what has preceded, *that the following combination of colours will produce white; viz. begin at any colour in the spectrum, and take of the 2d a proportion or quantity = to the 1st, 2d, and 3d; of the 5th a proportion = to the 4th and 6th; and of the 6th = 5th and 7th.*

EXPERIMENT XXIII.

Indigo	180	= to Violet 80 + Indigo 40 + Blue 60	
Yellow	87	= Green 60 + Orange 27	
Orange	93	= Yellow 45 + Red 48.	
Produce	360	White.	See Table E 1.

EXPERIMENT XXIV.

Orange	120	= to Yellow 48 + Orange 27 + Red 45	
Indigo	140	= Violet 80 + Blue 60	
Blue	100	= Indigo 40 + Green 60	
Produce	360	White.	See Table E 2.

EXPERIMENT XXV.

Blue 160 = to Indigo 40 + Blue 60 + Green 60
Orange 93 = Yellow 48 + Red 45
Red 107 = Orange 27 + Violet 80

Produce 360 White. See Table E 3.

EXPERIMENT XXVI.

Red 152 = to Orange 27 + Red 45 + Violet 80
Blue 100 = Indigo 40 + Green 60
Green 108 = Blue 60 + Yellow 48

Produce 360 White. See Table E 4.

EXPERIMENT XXVII.

Green 168 = to Blue 60 + Green 60 + Yellow 48
Red 107 = Orange 27 + Violet 80
Violet 85 = Red 45 + Indigo 40

Produce 360 White. See Table E 5.

EXPERIMENT XXVIII.

Yellow 135 = to Green 60 + Yellow 48 + Orange 27
Violet 85 = Red 45 + Indigo 40
Indigo 140 = Violet 80 + Blue 60

Produce 360 White. See Table E 6.

EXPERIMENT XXIX.

Violet 165 = to Red 45 + Violet 80 + Indigo 40
Green 108 = Blue 60 + Yellow 48
Yellow 87 = Green 60 + Orange 27

Produce 360 White. See Table E 7.

From the circumstance, that if four following colours be taken, a shade intermediate to the 2d and 3d, will be produced; it is evident, that *white should be produced by that shade, or tint, equal in quantity to the 1st, 2d, 3d, and 4th colours, combined with the 6th colour, equal in quantity to the 5th, 6th, and 7th.* By this method white may be produced by the combination of two colours, or rather by one prismatic colour, and a shade intermediate to two others, which shade may be distinguished by a name compounded of the two colours, to which it is intermediate.

EXPERIMENT XXX.

Indigo Blue 240 = Violet 80 + 40 Indigo + 60 Blue + 60 Green
Orange 120 = Yellow 48 + Orange 27 + Red 45

360 White. See Table F 1.

EXPERIMENT XXXI.

Blue Green 208 = Indigo 40 + Blue 60 + Green 60 + Yellow 48
Red 152 = Orange 27 + Red 45 + Violet 80

360 White. See Table F 2.

EXPERIMENT XXXII.

Green Yellow 195 = Blue 60 + Green 60 + Yellow 48 + Orange 27
Violet 165 = Red 45 + Violet 80 + Indigo 40

360 White. See Table F 3.

EXPERIMENT XXXIII.

Yellow Orange 180 = Green 60 + Yellow 48 + Orange 27 + Red 45
Indigo 180 = Violet 80 + Indigo 40 = Blue 60

360 White. See Table F 4.

EXPERIMENT XXXIV.

Orange Red 200 = Yellow 48 + Orange 27 + Red 45 + Violet 80
Blue 160 = Violet 40 + Blue 60 + Green 60

360 White. See Table F 5.

EXPERIMENT

EXPERIMENT XXXV.

Red Violet 192 = Orange 27 + Red 45 + Violet 80 + Indigo 40
Green 168 = Blue 60 + Green 60 + Yellow 48

360 White. See Table F 6.

EXPERIMENT XXXVI.

Violet Indigo 225 = Red 45 + Violet 80 + Indigo 40 + Blue 60
Yellow 135 = Green 60 + Yellow 48 + Orange 27

360 White. See Table F 7.

It may perhaps be found that this is the moſt harmonious combination of colours poſſible; and that which perſons of taſte would adopt with the happieſt effect in their dreſs, in the colouring of their apartments, or in any ſubject which colours are employed to embelliſh.

In part 2d, of the 76th vol. of the Philoſophical Tranſactions, for the year 1786, a very intereſting and ingenious memoir is publiſhed, containing various experiments by Dr. Robert Darwin, on the ocular ſpectra of light and colours. In this memoir it is obſerved, that if a piece of coloured ſilk, about an inch in diameter, be placed on a ſheet of white paper, about half a yard from the eye, and it be looked upon ſteadily for a minute, and the eye be then removed to another part of the white paper, a ſpectrum will be ſeen of the form of the ſilk; but of a colour oppoſite to it, viz.

Red ſilk	produces a	blue green ſpectrum.
Orange	. . .	an indigo blue.
Yellow	. . .	a violet indigo.
Green	. . .	a red violet.
Blue	. . .	an orange red.
Indigo	. . .	a yellow orange.
Violet	. . .	a green yellow.

Now theſe ſpectra are preciſely of the colour which, combined with that colour which produced them, compoſe white, agreeable to the Experiments from F 1 and F 7.

In the Philoſophical Tranſactions for the year 1794, Part 1ſt, page 107, there is an account of ſome very intereſting experiments on the effects of light tranſmitted through coloured glaſs, by Sir Benjamin Thompſon, Count Rumford: *e. g.* provide two candles, and let the light proceeding from one, paſs through a coloured glaſs; let the other candle be ſo much farther removed from an object intercepting the light of both, that the two ſhadows of that object produced by the candles be equally ſtrong; or in other words, let the light tranſmitted through the glaſs, when it falls on the object, whoſe ſhadow is to be received, be equally intenſe with the light proceeding immediately from the more diſtant candle; one of theſe ſhadows will be of the colour of the glaſs, the other will be the oppoſite colour, or that colour which combined with the tranſmitted colour would produce white.

The two ſhadows produced by two candles, one tranſmitting the light through a coloured glaſs, the light of the other falling immediately on the object will be,

If the glaſs be Violet —Violet and green yellow
Indigo —Indigo and yellow orange
Blue —Blue and orange red
Green —Green and red violet
Yellow—Yellow and violet indigo
Orange—Orange and indigo blue
Red —Red and blue green.

Theſe Experiments, which are eaſily made, and very amuſing, coincide with thoſe from F 1 to F 7, No. 30 to 36, and with the Experiments on the Ocular Spectra, made by Dr. Robert Darwin, and referred to in Dr. Darwin's Zoonomia; a work which may be conſidered as one of the firſt productions of the human mind.

Fig. 3. Is a table ſhewing the numeral relation which the ſeveral colours bear to each other, beginning with any colour in the priſmatic ſpectrum.

Birmingham. S. GALTON, Jun.

To the Editor of the Monthly Magazine.

SIR,

SUPPOSING the National Debt to be equal to four hundred millions (or more of 3 per cent. Annuities, of the value of 50 per cent. that is, two hundred millions ſterling; *fifty millions*, or more if it can be employed, of this property, may be put into circulation, in the following manner. Let any ſtockholder, who would wiſh to circulate ſome part of his ſtock, without ſelling it, transfer a certain quantity of it, ſuppoſe twenty thouſand pounds 3 per cents. to the Governors and Directors of the Bank, who are then to deliver to him fifty certificates, or notes of transfer; each of them to be marked as of the value of 100l. or a greater quantity in number, and of leſs value