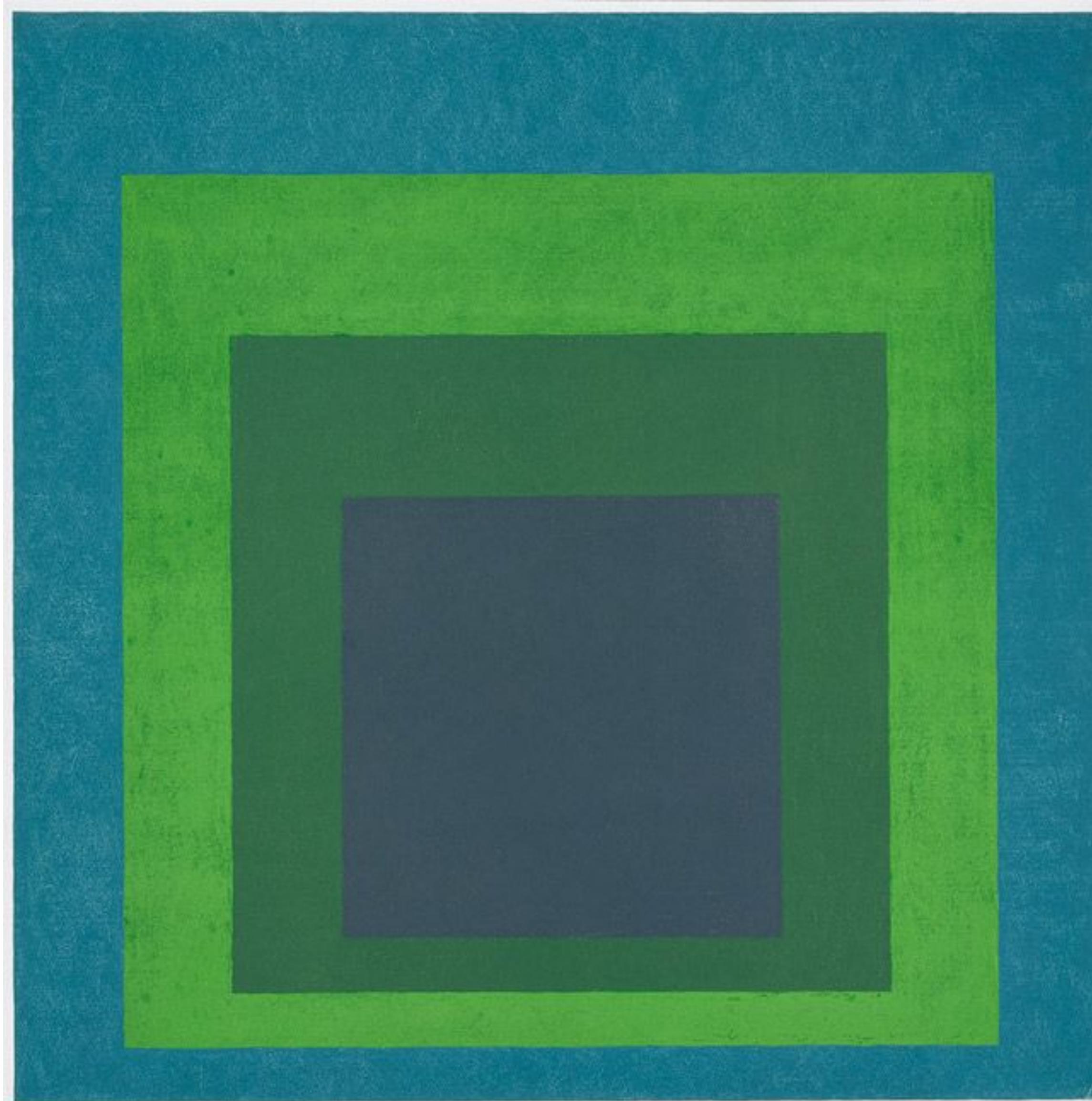


# **Notes about a Constructive Colour Theory**

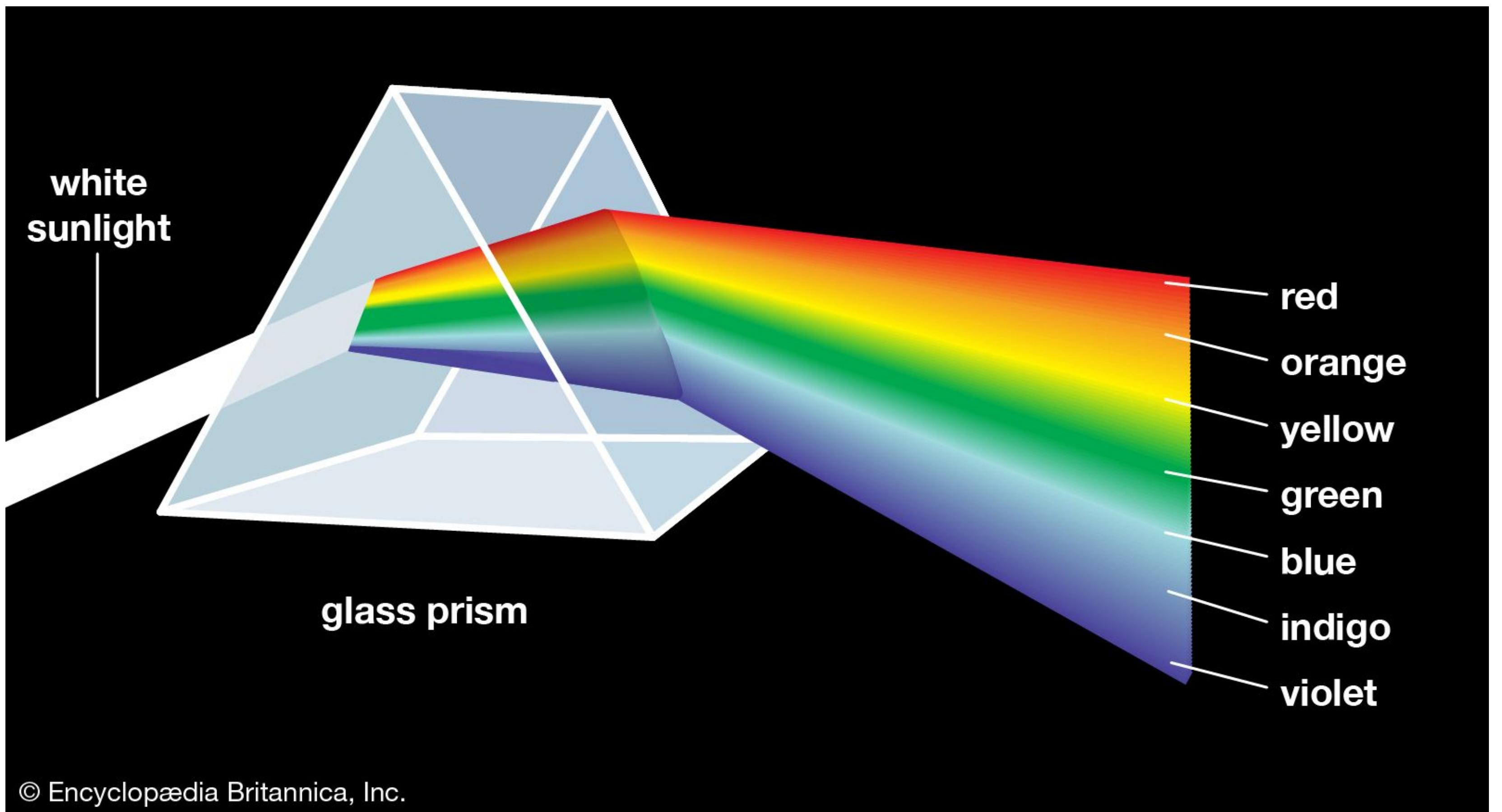
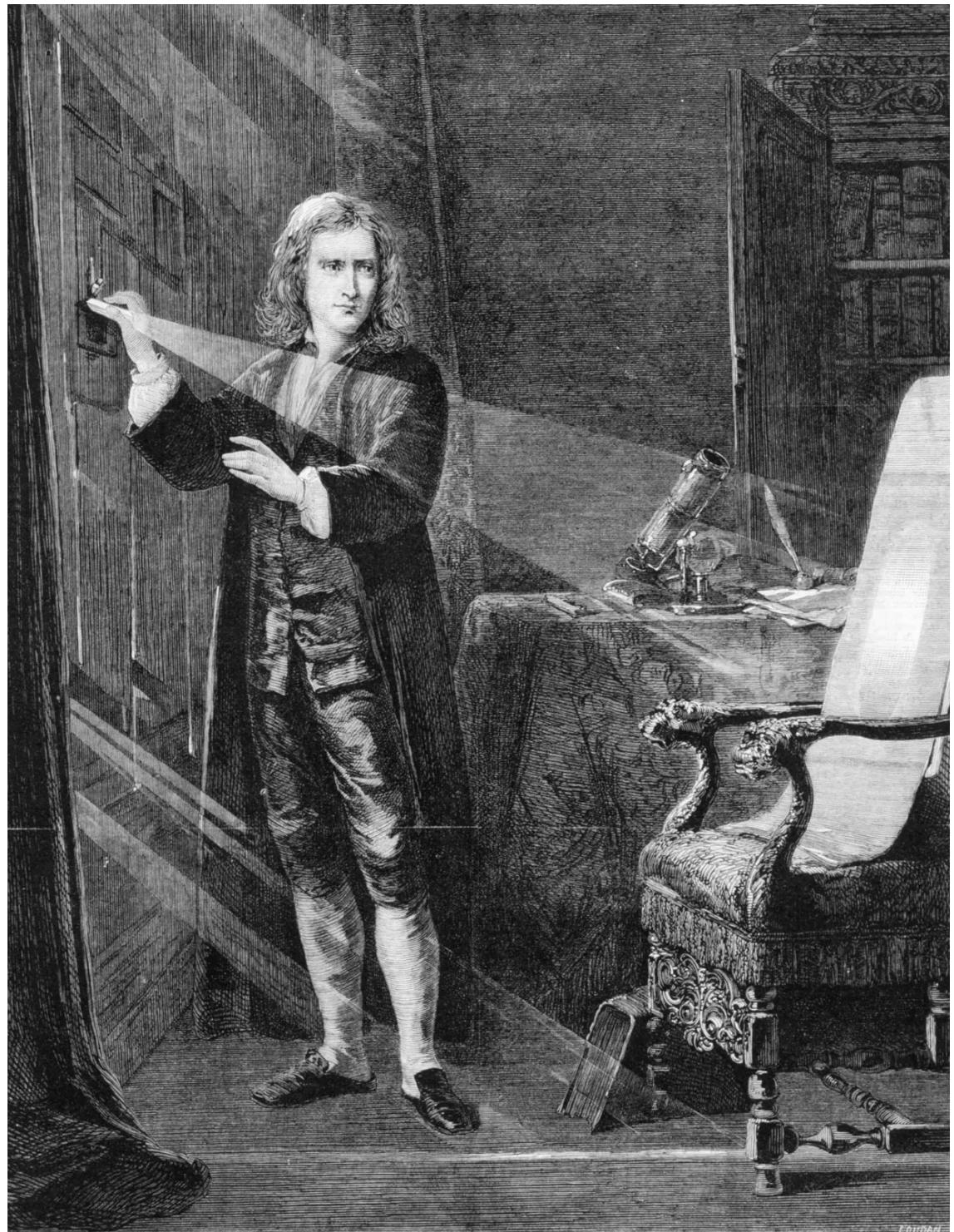
# Colour is mysterious



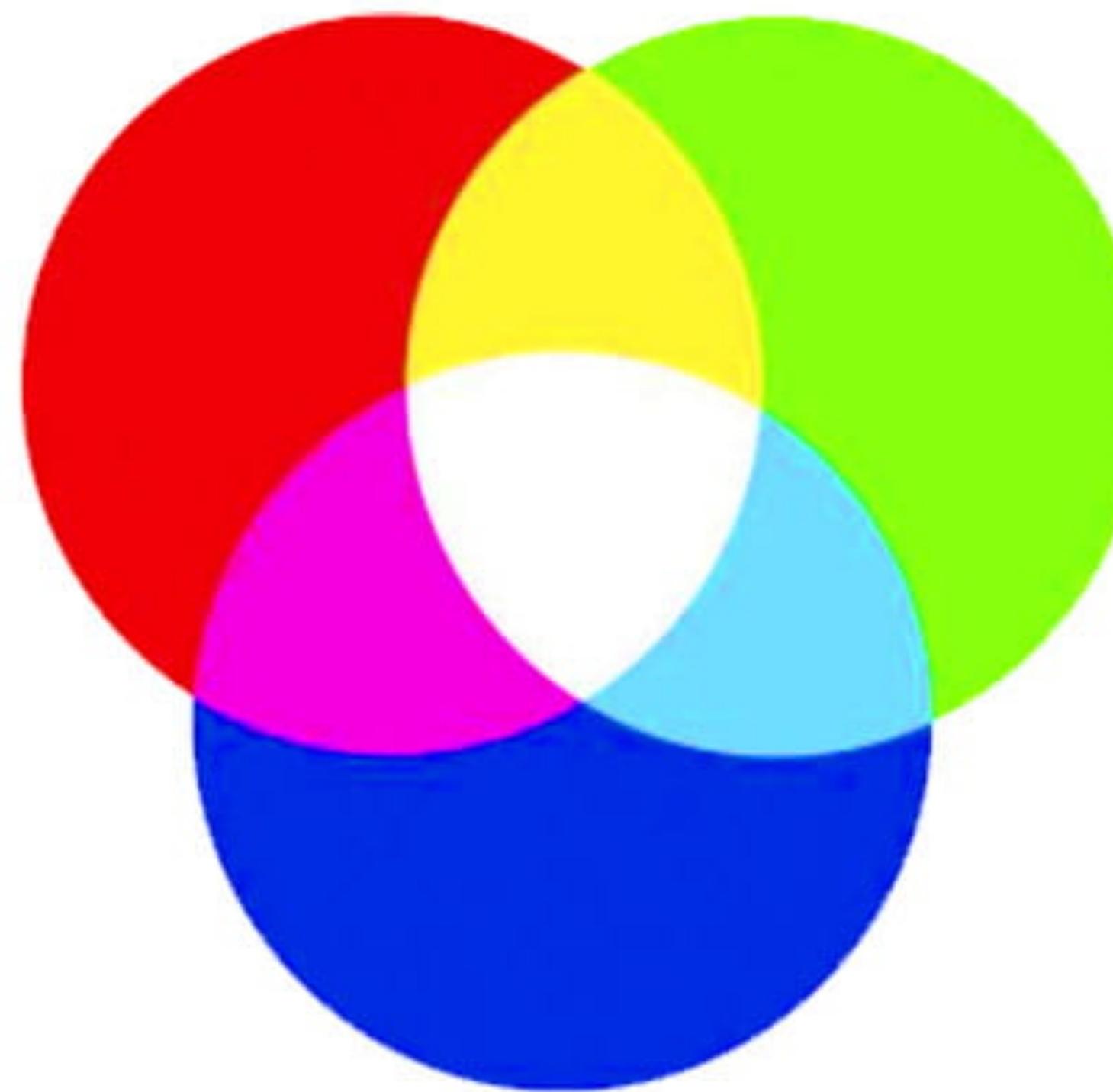




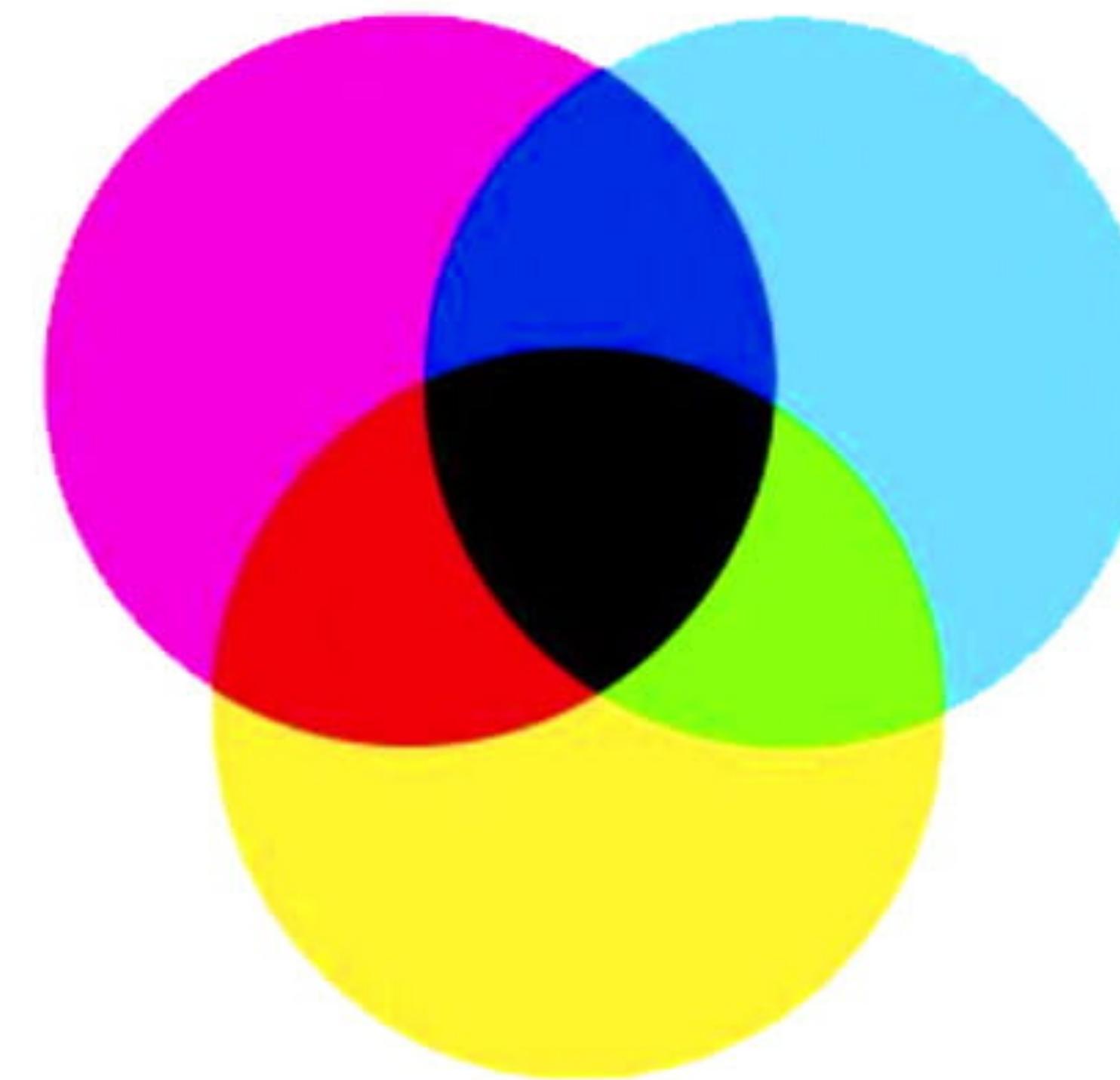
# LIGHT



# Mixing Light



Additive colour mixing



Subtractive colour mixing

# Colour Theory for Painters

## Primary, Secondary, Tertiary colours

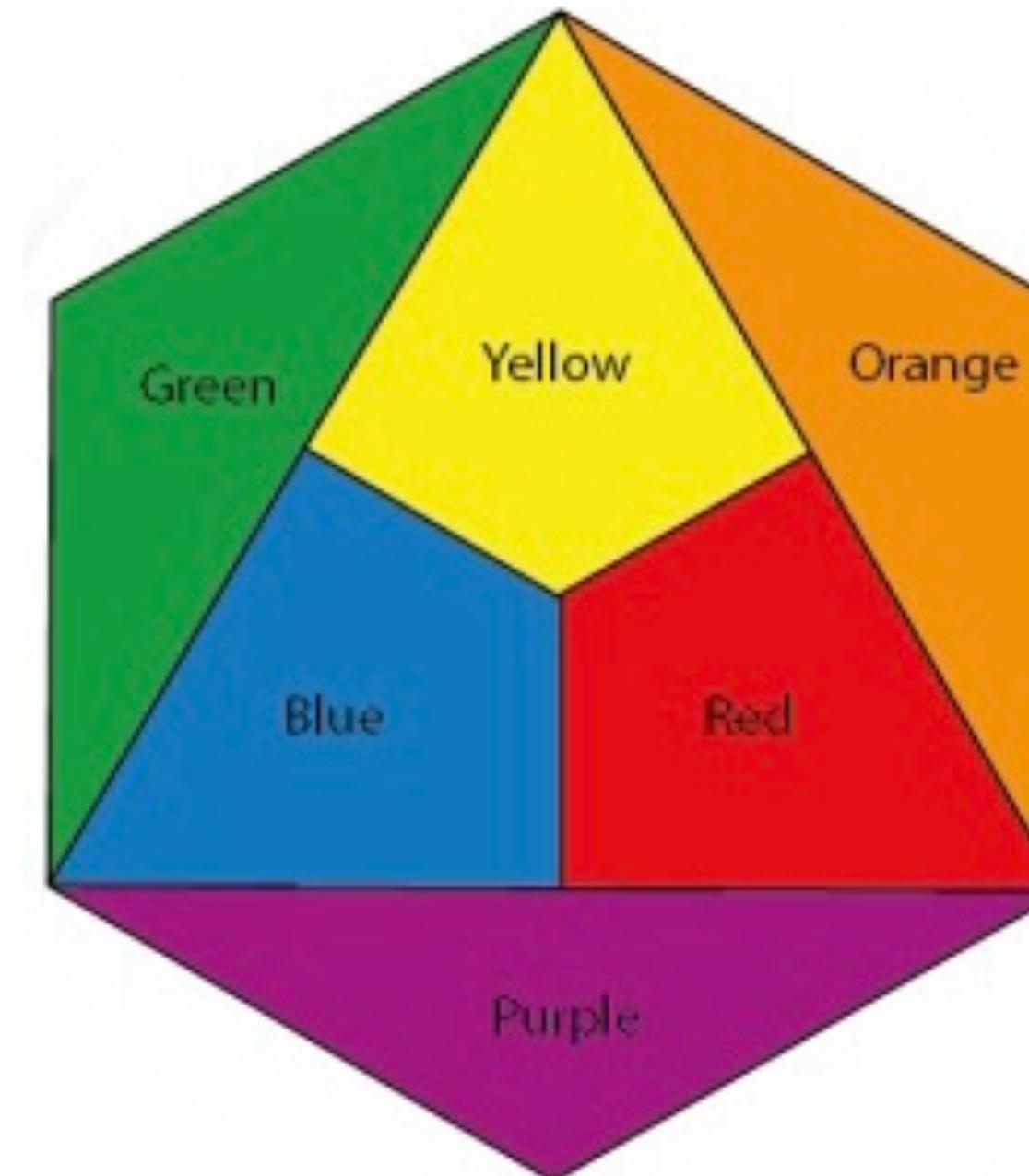


# Writing something down

G = YB

P = BR

O = YR



# Writing something down

$G = YB$

$P = BR$

$O = YR$

$YG = YYB = Y^2B$

$BG = BYB = YB^2$

... etc...



# Monoid of Paint

(RGB version)

- Colours are freely generated from {R, Y, B}
- commutativity:  $xy = yx$
- associativity:  $x(yz) = (xy)z$
- unit:  $1x = x$

# Introduction of GREY and complementary colours

**New Law:** RBY = 1



# Introduction of GREY and complementary colours

**New Law:** RBY = 1

**Opposite of x is a y , s.t. xy = 1.**



# Introduction of GREY and complementary colours

# Introduction of GREY and complementary colours

- Calculating the opposite of red:

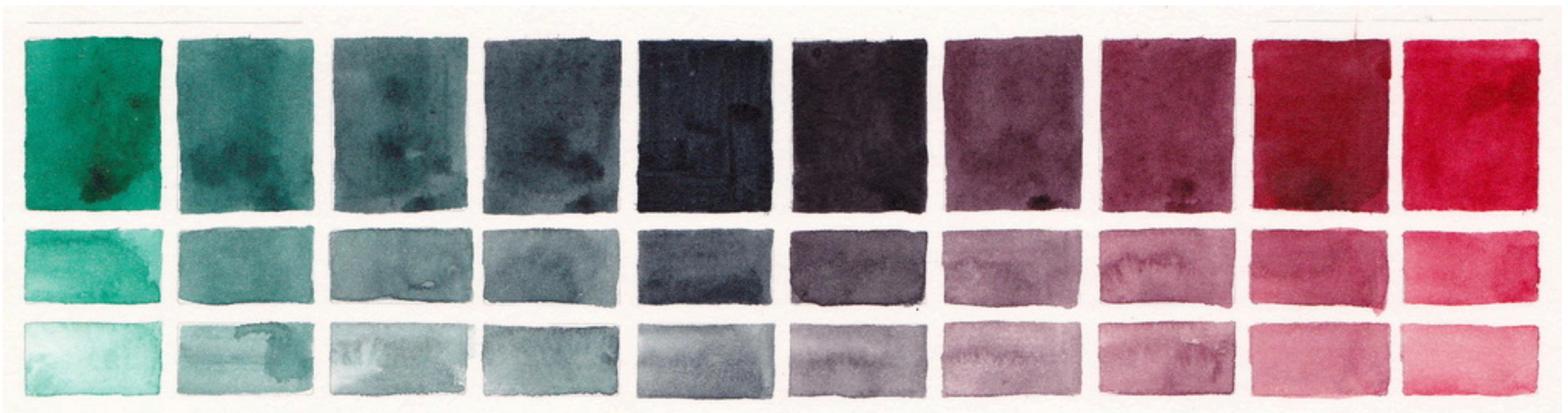
$$R^{-1} = R^{-1}I = R^{-1}RBY = BY = G$$

- Similarly:

$$B^{-1} = RY = O$$

$$(RO)^{-1} = R^{-1}O^{-1} = BYB = YB^2 = BG$$

# Complementary colours mix to Gray



# GENERALISATION - arbitrary bases

- colours are freely generated from a finite  $C$
- multiplication which is commutative, associative
- unit 1
- inverse  $^{-1}$
- law of grey:  $\Pi C = 1$  - white ballance
- Lemma:

$$\forall x \in C \mid x^1 = \prod_{y \in C, y \neq x} y$$

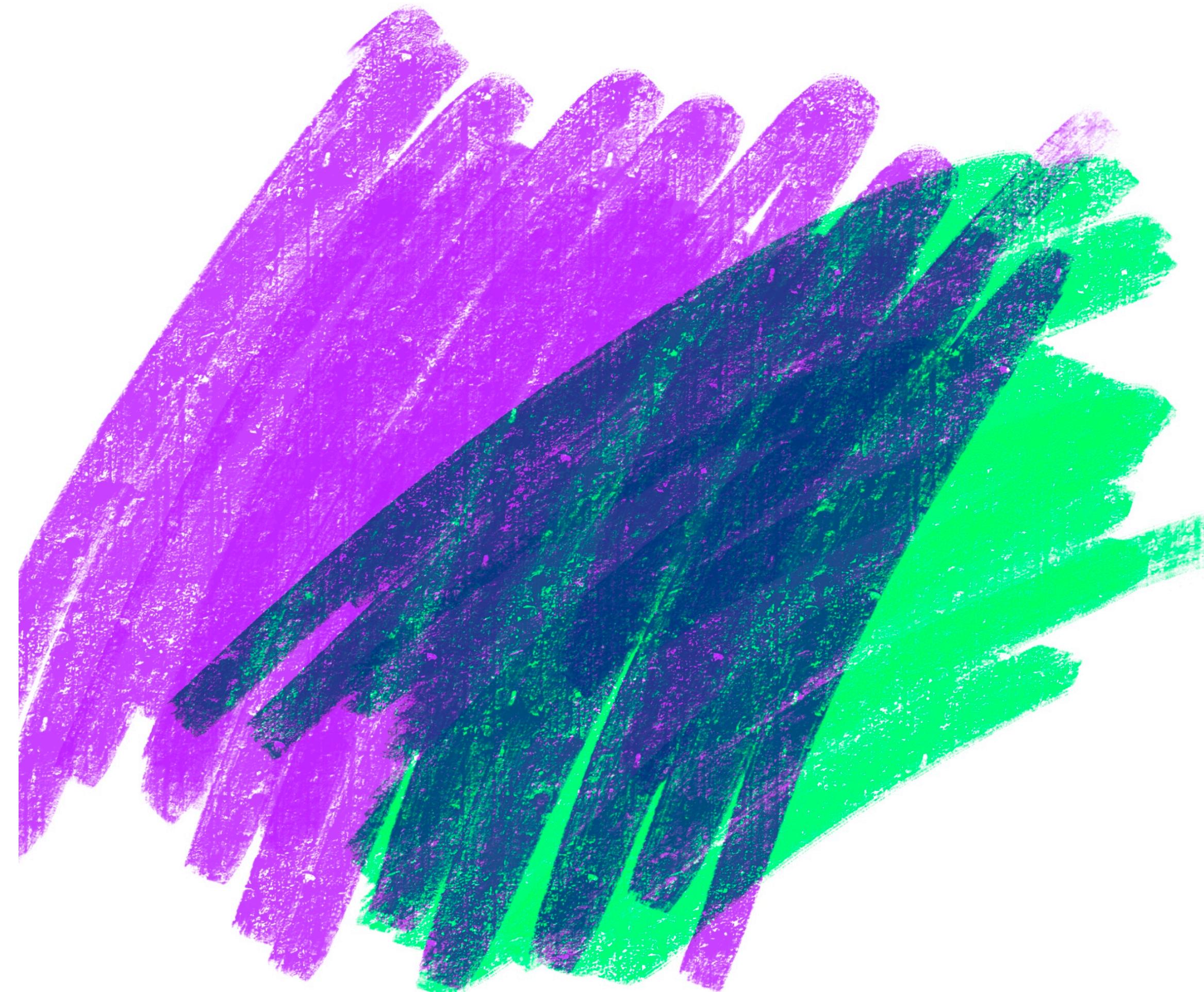
# Demonstration: Mixing Primaries from Secondaries

- $R = R1 = RRBY = (RB)(RY) = PO$
- $B = B1 = BRBY = (BR)(BY) = PG$
- $Y = Y1 = YRBY = (RY)(BY) = OG$



# Demonstration: Mixing Primaries from Secondaries

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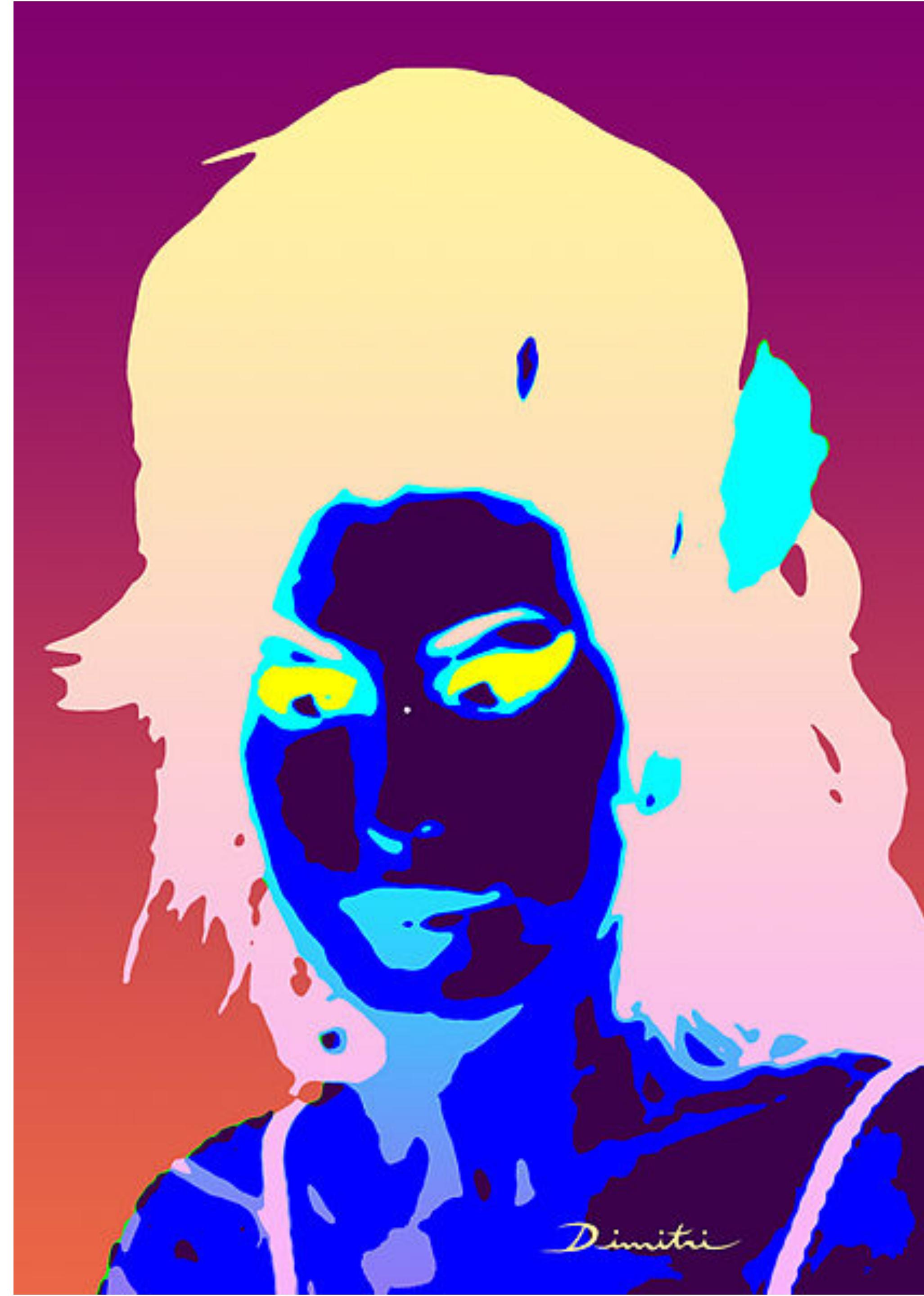
# Colours in a context: Relativity of Colour

- Colour constancy
- Colour afterimage
- Colour is context sensitive
- Same colour appears different, Two colours appear the same

# Colour Constancy

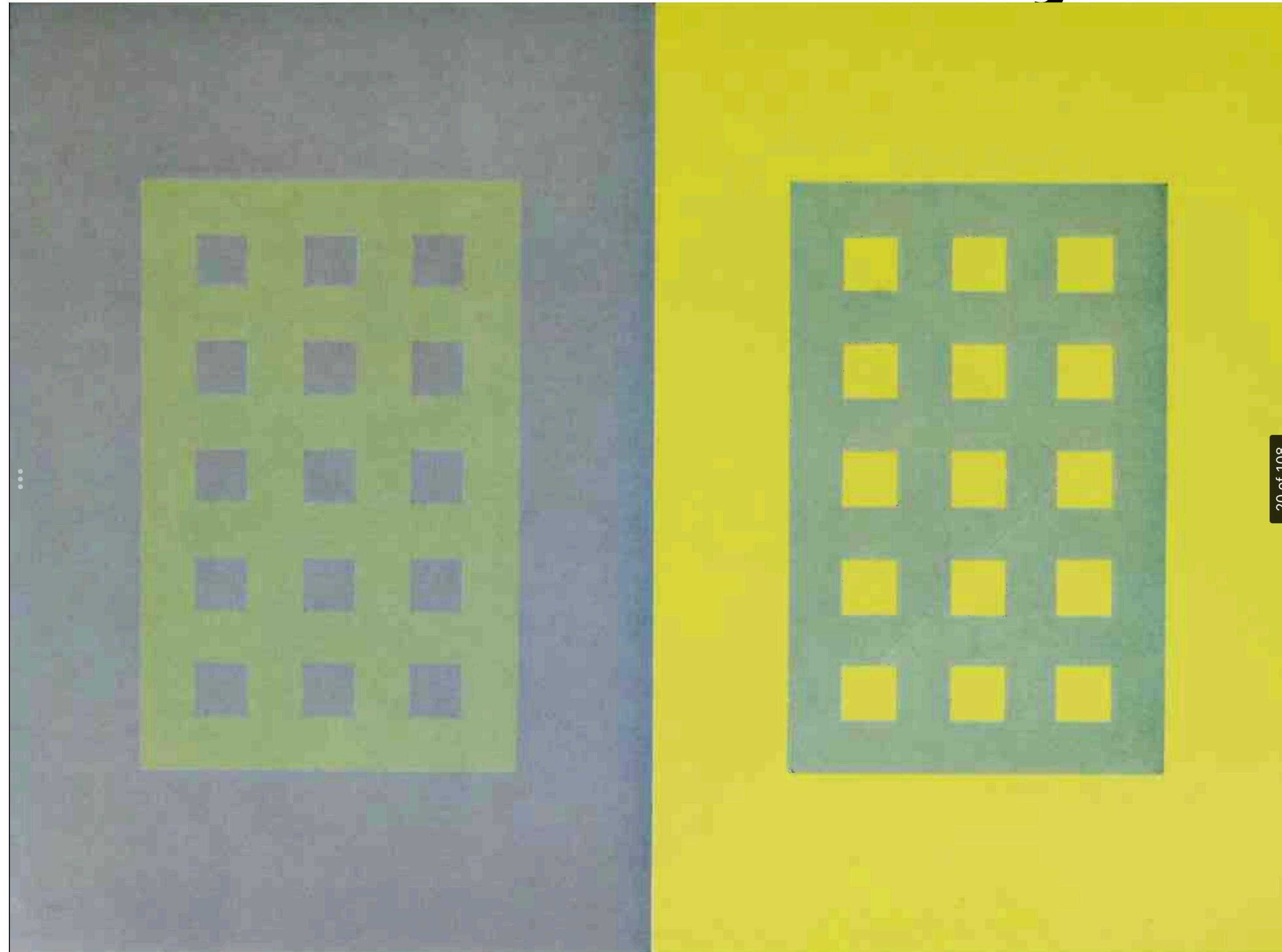
- Under the stress of constantly changing light situation, the brain needs to invent a constant and consistent interpretation of the world







# Colour Relativity



# Writing it down

- Interpret colours as colour squares
- Introduce new operator  $\dots X | Y$ , to put colour square Y into X



# Colour in context

- $[X|Y]$  to mean the colour inside , and rule  $[X|Y] = X^{-1}Y$

