Turn a colour with emotion: a linguistic construction of colour in English

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What colour-emotion associations are entrenched in English colour constructions? Colour term constructions have evolved from predicative descriptors (*the sky is blue*) to cover nominal (*blue is beautiful - the sky is a beautiful blue*), actional (*the sky reddened*), and adverbial functions (*the sky went/turned/became/grew red*). The conventional unit pairing of meaning with form leads us from a mental representation to a lexical concept that is then associated with a construction. The objective of this paper is to analyse the complex predicative metonymic basic colour term construction X (*CHANGE*) Y with Z, which is an expanded metaphorical construction of X (*BE*) Y with Z, as in *He went/turned white with fear*. In this study two different usage-based methods have been employed to verify what colour terms are associated with specific emotions. The first method was a corpus analysis conducted using the Corpus of American English and the Corpus of Historical American English. The second method involved three questionnaire tests (106 informants). Results show that associating a colour to a given emotion made for greater consensus, than the other way around. This research argues that the relationship of colour-emotion constructions are well entrenched for English speakers. They are conceptualised through metaphor and metonymy that have roots in embodied physical and psychological experiences. Priming these constructions is accessed more directly via emotion, though the colour-emotion association varies according to contextual constraints.

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Introduction

Basic colour terms (BCTs) evoke a semantic frame [1] that is defined through our embodiment of vision [2-5]. Colour terms, within the COLOUR frame, may take on multiple meanings and positive or negative connotations depending on how they are conceived in the object/surround association [6]. For example, in English each BCT has one or more conventionalised linguistic associations with an emotion that fit into the colour construction (with the possible exception of orange, see corpus analysis, Table 2). Starting with the understanding that certain colour terms are found in the linguistic colour construction [X [BECOME] Y with Z], as in *He turned red with anger* [7]; the questions posed in this study about English are the following: Are the COLOUR-EMOTION constructions, made up of a COLOUR term and an EMOTION term well entrenched? And if so, to what degree and how are they accessible to an English speaker? What emotions and colours are associated together in this construction?

In considering linguistic analysis of colour conceptualisation it is necessary to recognise the intrinsic properties of an entity that: may change colours, or may be more than one colour at a time [8]. By intrinsic I mean: of or relating to the essential nature of a thing; inherent [9]. This study concentrates on the property of colour change and emotion and how it is expressed in language. For example, when a person becomes angry the change in blood pressure may cause the face to flush red. When a person is frightened the loss of blood circulation may cause the face to lose colour, or to *whiten*. In a similar way a person who feels nausea or envy is conventionally conceived as suffering a rush of bile and the colours *yellow* and *green* are associated with the resulting face tone. *Blue* tends to be connected to the physical sensation of coldness or lack of warmth. By metaphoric extension, through correspondence of lack of energy with lack of warmth, *blue* emerges with the association of sadness, depression and melancholy. These emotions spill over into tiredness and boredom, which are also connected with lack of colour, thus *grey* and *brown*. *Purple* is associated with intense anger, or rage, in the same way that the subordinate terms *scarlet* or *crimson* are. *Pink* in the face is normally related with health. But when it is linked to flushed cheeks, pink may be associated with embarrassment, shame, or a state of arousal. *Orange* is often connected to the sunshine and consequently to happiness, though there are no observable conventional linguistic colour constructions with it (as confirmed in this study's corpus analysis). These embodied associations most likely have similar roots to the ancient Greek conceptualisation of bodily humors, which also carried over into medieval times [5,10]. This study hypothesised that the emergent COLOUR-EMOTION associations in the colour construction would be in keeping with these embodied and historically conventionalised patterns.

In this section I present and discuss the basic aspects of the COLOUR-EMOTION construction analysis. These aspects include: basic cognitive linguistic concepts, the usage-based analysis and course of action adopted, the basic colour terms used in the analysis, the colour construction investigated, the definition of an emotion as understood in this paper, and three past studies on colour and emotion with which this study interfaces.

I use a few typographic norms in this paper. Capital letters are used in the text to indicate a concept rather than the lexeme, and italics indicate the examples of the concept. In the tables, capital letters are used to indicate the lexeme given in the linguistic task compared to the normal print informant response and bold print indicates majority agreement. All of the utterance examples have been selected from the corpora: the Corpus of Contemporary American English (COCA) and Corpus of Historical American English (COHA) [11].

1.1 Basic cognitive linguistic concepts

Before proceeding with the analysis at hand, I would like to point out that some of the cognitive semantic terminology employed in this paper is explained in a final glossary. Specifically the terms I clarify are: *semantic frame*, *embodiment*, *linguistic construction*, *conceptual metaphor*, *conceptual metonymy*, and *cognitive model*. Although there are numerous scholars who have written about these complex topics, I indicate a principle scholar of reference and synthesise the concepts.

The approach used for analysis in this paper is strictly a linguistic approach. I use some psychological texts to identify what is generally considered an emotion, but I am interested in the linguistic categorisation and perspective, rather than a psychological analysis per se, hence the reader may find some differences from more traditionally psychological investigations. The groupings of the superordinate and subordinate categories of both the colours and emotions follow dictionary definitions [9], and the indications of the studies described in Section 1.5.

1.2 Usage-based analysis

In keeping with the cognitive linguistic paradigm, this study employs two different usage-based methods to verify what colour terms are associated with specific emotions in the given construction. These methods may be understood to reflect the top-down and the bottom-up approaches to cognitive phenomenon. The bottom-up approach starts from the analysis of entities that are smaller in scope and build up to an explanation of the phenomenon. This approach corresponds with the corpus analysis conducted with COCA and COHA [11]. The top-down analysis starts from introspective data to give an abstract characterisation of the cognitive processing. This corresponds to the analysis of the three questionnaires that presented the informants with a series of queries to see what COLOUR-EMOTION associations are most entrenched.

Entrenchment is expressed through conceptual metaphors and metonymies that have their roots in physical and psychological experiences. Entrenched associations are stable, are subject to conventional constraints, and reflect a default status [12]. EMOTION and COLOUR are primary human concepts. EMOTION and COLOUR [SEEING] [13] may be considered universal embodied experiences. Entrenchment and universality are two aspects that make this investigation particularly pertinent in discourse on language processing.

1.3 Basic colour terms

This study takes into consideration the eleven basic colour terms in English. The BCTs in English are: six primary - BLACK, WHITE, RED, YELLOW, GREEN, BLUE, and five secondary - BROWN, GREY, PURPLE, ORANGE, PINK [14-15]. The primary BCTs are more frequent in language than the secondary BCTs [3,6]. In keeping with this, BCTs are more salient and carry greater polysemic weight than other colour terms. Numerous linguistic constructions have developed through metaphoric and metonymic extensions of colour senses (e.g. *The sky is red. Murray Sr. is in the red. Mother is red in the face*). Colour metaphoric extensions emerge through the category dimensions of hue, saturation, and brightness/lightness [4,6], or as Biggam identifies the semantic colour dimensions hue (chromatic colour), saturation (the purity or otherwise of a hue), and tone (the admixture of white or black with a hue) [16]. Colour sense extensions also arise from the same conceptual capacities that can give rise to different conceptual colour systems [17]. All eleven BCTs are taken into consideration in this study.

1.4 Colour term construction

Colour term constructions have evolved from predicative descriptors (*the sky is blue*) to cover nominal (*blue is beautiful - the sky is a beautiful blue*), actional (*the sky is reddened*), and adverbial functions (*the sky went/turned/became/grew red*). A construction is the conventional unit pairing of meaning with form that leads us from a mental representation to a lexical concept with which it is then associated [11,18-19] (see Glossary). Specifically, the objective of this paper is to analyse the complex predicative metonymic BCT construction [X [BE] Y with Z] in the expanded metaphorical construction of [X [BECOME] Y with Z]. For example, the 'state of being' *He is white with fear* may be transformed into a 'change of being', as expressed through *He went/turned/became/grew white with fear*. CHANGE IS MOTION is the underlying conceptual metaphor that marks a shift from a still concept image (be) to a dynamic concept image (become/go/turn/grow) – elucidated as summary scanning vs. sequential scanning [11,18]. The accompaniment role of "with Z", as in [X [BECOME] Y with Z], allows for the shift from, for example, *John went home with Mary* to *John went green with*

envy. In the colour construction X is the person-subject, Y is a colour term, and Z is the emotion that accompanies the colour. It is conventionally associated through our embodied experience, or we can say that it is experientially motivated [20] (see Glossary). The conceptual metaphor-metonymy expressed by the BCT changes according to the individual frame triggered by each construction.

1.5 Basic cognitive linguistic concepts

To classify the emotions in both parts of this study it was necessary to identify a definition of emotion to adopt. The parameters used were put together on the basis of research carried out by four authors. An emotion is different than a *feeling*, a *state of being*, or a *mood*. An *emotion* is a complex unconscious reaction that emotes through a cognitive program that includes certain ideas and modes of cognition. It is a biologically determined process that is dependent on predisposed innate cognitive mechanisms [21]. According to Damasio, *feelings* are composite perceptions of what happens in our body and mind when we are emoting, whereas *feelings of emotion* are images of actions, rather than actions themselves. A *state of being* is very much like a mood in that it is prolonged through time. It may be related to a physical response like hunger or thirst. A *mood* is an emotional state that has a more lasting effect. It is a background sensation. For example, you can be in a good mood or in a bad mood [21].

Damasio divides emotions into universal-primary and social-secondary. The universal emotions he lists include: *happiness*, *sadness*, *anger*, *fear*, *surprise* and *disgust*. The social emotions he mentions are: *compassion*, *remorse*, *embarrassment*, *shame*, *guilt*, *pride*, *jealousy*, *envy*, *gratitude*, *admiration*, *indignation* and *contempt* [21-23]. He also points out how social emotions may vary culturally [21]. Kövecses instead makes a linguistic distinction between expressive and descriptive emotions, separating five basic emotions: *anger*, *sadness*, *fear*, *joy* and *love* [24]. Other research based on linguistic analysis of emotions performed by Johnson-Laird and Oatley, quoted by Power, lists five basic emotions, from which other complex emotions are defined [25]. They argue that the five basic emotions provide "semantic primitives" from which other emotions are derived. They list basic emotions in capitals, and the other emotions as subcategories of the basic ones: *ANGER*: *frustration*, *irritation*, *aggression*, *jealousy*, *resentful*. *SADNESS*: *despair*, *misery*, *defeated*, *gloominess*, *mournful*. *DISGUST*: *shame*, *guilt*, *repulsion*, *humiliated*, *blameworthy*. *FEAR*: *anxiety*, *nervousness*, *tense*, *worried*, *shy*. *HAPPINESS*: *joy*, *elation*, *pride*, *loving*, *cheerful*. According to Ekman there are six basic emotions, namely *fear*, *anger*, *joy*, *disgust*, *surprise* and *sadness* [26]. He specifies that emotion has a quick onset and a brief duration.

All of the four authors agree that *anger*, *sadness*, *happiness* (*joy*) and *fear* are basic emotions, three different authors list *disgust*. Two authors, Damasio and Ekman, list *surprise*; *love* is indicated as an emotion only by Kövecses. Of course I cannot delve into the intricacies of emotion and the extensive scholarship on the subject, my objective is to see which basic emotions are generally considered in the literature to be able to select which terms to use in the linguistic questionnaire.

1.6 Past studies on COLOUR and EMOTION

Most often COLOUR is considered in relation to the EMOTION it evokes [27]. Studies tend to evolve around the material and visual aspects of colour and the environment, architecture, fashion, and graphics. There is also a consistent body of research that considers colour and preference. In this case there are three studies that I would like to mention specifically in relation to the present study. The first study, by da Pos and Green-Armytage, investigates the visual pairing of facial expressions of emotions with colours chips in two groups of informants: Europeans and Australians [28]. It employs the six emotions (see Section 1.5) and faces indicated by Ekman [26]. Their study also considers the

basic emotions as being fundamentally universal, though they found variation and degrees of intensity in interpretation of the emotions. It claims that the results would appear to confirm consensus among individuals in perceiving emotional facial expressions, colours, and the relationships, possibly on the basis of universal biological roots.

The second study, by Simmons, on colour and emotion, observes that the associative links between certain colours and emotions have not always been proven, and argues for the need of a protocol for establishing empirical links between colour and emotional terms [29]. He concentrated on the evaluation of visual colour stimuli with word associations, i.e. "pleasant", "unpleasant", "mood enhancing", and "calming", developing an experiment for each term. Furthermore, and pertinent to this study, he reports three different routes to emotion appraisal that are taken up in my discussion towards the end of this paper. The main conclusion in his study is that it is not always the hue dimension that is prominent in emotional responses, but saturation and brightness/lightness. This is confirmed also in da Pos and Green-Armytage's work [28]. Simmons finds that *pleasant* ratings correlate with short-wavelength dominant colours. He states that there is a body response via neural pathways to light sensitivity and melanopsin. The wavelengths affect the body stimulating or relaxing according to the context.

The third study, by Steinvall, more similarly to my study, uses a corpus analysis to verify the collocational patterns of colour terms and emotion terms [5]. Steinvall, too, observes the fundamental aspect of a dual associative approach: emotions in relation to colour categories and colours in relation to emotion categories. Considering the vastness of the correlations possible between the 50 colour terms and the 135 different emotion terms he investigated, the findings are quite straightforward. He proposes three metaphorical cognitive models as motivation for the associations found. They are: EMOTION IS HEAT, as in RED for *anger*, the darker the colour the more intense the emotion; EMOTION IS ILLNESS – humoral pathology – as in GREEN for *envy* or YELLOW for *disgust* (see introduction), and EMOTION IS WEATHER PHENOMENON, as in BLUE for *joy* (sky), YELLOW for *happiness* (sun) vs. GREY and BLACK for *sadness* (clouds).

Usage-based corpus analysis of COLOUR-EMOTION constructions

Bearing in mind that a construction serves to establish an emergent syntactic structure that lends for a conceptual 'Gestalt', "i.e. holistic conceptualisation and easy handling as a unit, qualities that facilitate entrenchment and memorability" p. 266 [30], I proceeded to conduct a corpus analysis to verify the presence of the COLOUR-EMOTION construction. As mentioned in Section 1.3, colour terms have evolved from predicative descriptors - [X IS Y] to cover nominal, actional, and adverbial functions: [Y IS Z] - [X IS a ZY], [X Y[en]+*ed*], [X [BECOME] Y]. X IS Y (X = N1; Y = N2 (ADJ1)) > Y IS Z (Y = N2 (ADJ1); Z = N3 (ADJ2)) > X Y+*ed* (X=N1; Y=V1 (N2 (ADJ1))). In these expressions N stands for noun, ADJ for adjective, and V for verb.

2.1 Various COLOUR-EMOTION constructions

The complex predicative metonymic BCT construction thus is [X IS Y with Z]. The attribute part of the object (Y) is the first object in: *The tree is white with snow*, which is the basic construction that allows for us to connect the attribute with the emotion as in: *Jeff is white with fear*. The construction expands to: [X [BECOME] Y with Z] that is [X [BECOMES or CHANGES TO] Y with Z] meaning "X becomes or changes to Y caused by Z". This requires activation of a *metaphorical* extension as in: *The tree goes/turns/grows/becomes white with snow*, which also allows for us to adopt the emotion as the object: *Jeff goes/turns/grows/becomes white with fear*. The underlying conceptual metaphor

CHANGE IS MOTION marks the shift from BEING to BECOMING. When Y is a colour term, the going or movement construction functions with the other conceptual metaphor: A STATE (A COLOUR) IS A LOCATION. The conceptual metaphor-metonymy expressed by the BCT Y – a location – changes according to the individual frame triggered by each subject COLOUR-EMOTION construction. Note the accompaniment role of *with Z*, which stems from the primary construction [X [MOVES TO] Y *with Z*] – e.g. [TO GO [SOMEWHERE] WITH [SOMEBODY, SOMETHING]]. X is N1 that MOVES TO Y, which is N2 (a location), and Z is N3. For example: *John went home with Jane*. When Y is a colour term, Z corresponds to the cause that is conventionally associated metonymically or metaphorically through our embodied experience, e.g. *John went black with rage*.

There are different verbs used to indicate the change, or the becoming, in the construction [X [BECOME] Y with Z]. Two examples are given here per verb, though all the verb tenses were found in the corpora. They include [GO] as in the examples: *The leaves went yellow with age - Beavis goes white with fear*; [TURN]: *The sodden brown soil will turn green with life - That made her turn red with anger when she thought of it*; [GROW]: *Brass chandeliers have grown black with tarnish - Wex grew red with embarrassment*; [BECOME]: *The skies of blue become black with stars - Her face flushed, then became white with wrath*.

This construction could be further illustrated as [X [GO] Y with Z], that is [X [MOVES TO] Y with [the company of] Z]; as in *Bill goes to Seattle with Mary*. [X [CHANGES TO] Y with [the accompanying cause/effect] Z; as in *John went to Seattle with a goal in mind, The crowd went wild with* excitement or *Tish went white with anger*. The expression of the specific construction is: [X [GO/TURN/GROW/BECOME] [COLOUR] with [EMOTION]]. Such constructions are not lexically filled, but represent a grammatical schema, which can be instantiated with particular words.

2.2 Corpus analysis method

I elaborated the colour construction corpus analysis through COCA that contains more than 450 million words of text from 1990-2012, and COHA that contains 400 million words from 1810-2009. They are divided among spoken, fiction, popular magazines, newspapers, and academic texts. The objective of this part of the analysis was to verify what verb is used most frequently in the COLOUR-EMOTION construction, and to see what EMOTIONS are used most for the eleven BCTs, to be able to choose the most entrenched form of the construction for the questionnaire tests.

I first inserted the search string: [VERB] [white|black|red|yellow|green|blue|grey|brown|purple|orange|pink] WITH, into the corpus website window for each verb. I then counted the EMOTION occurrences for each verb, and calculated the percentage of occurrences for all of the [VERB] [COLOUR] WITH results, for each verb, each corpus, and the sum of the two corpora (Table 1).

[VERB] [COLOUR] WITH	EMOTION occurrences with all the colours in 326 occurrences in COCA	EMOTION occurrences with all the colours in 938 occurrences COHA	Total EMOTION occurrences with all the colours in the COCA and COHA
BE	11.3%	7.0%	8.1%
GO	1.2%	2.6%	2.2%
TURN	1.8%	6.5%	5.3%
GROW	0.6%	7.0%	5.2%
BECOME	0%	0.8%	0.6%

Table 1: Percentage of EMOTION occurrences of each VERB with total COLOUR-WITH construction occurrences.

2.3 Corpus analysis results

BECOME was not found in the COLOUR-EMOTION construction in COCA, and was found in COHA. Table 1 shows the percentage of EMOTION occurrences of the stative construction with BE that was higher than the dynamic constructions with GO, TURN, and GROW. Each verb is listed in the table with the number of emotion occurrences with all the BCTs in each corpus separately and then in a combined calculation of both corpora.

BE constructions resulted highest of all in the contemporary corpus. All the other verbs GO, TURN, GROW, and BECOME resulted to be more frequent in the historic corpus. Though TURN is the most frequent dynamic verb in this construction, it is pertinent to point out that the examples of GROW were more frequent before the 1900's, and the percentage of TURN results were more spread through the two corpora.

The results for RED can serve as an example to better explain the type of patterns that became evident. Of 24 occurrences for BE only 40% were with an emotion, of the occurrences with GO 50%, TURN 65%, and GROW 33% were with an emotion. A majority of the other examples were physical causes or effects, e.g. with *strain*, *exertion*, *tears*, *crying*. The most common emotions for RED were *rage*, *embarrassment*, *anger*, *fury* and *shame*.

The results for the top five emotions for each colour are listed in Table 2. COHA results are listed with an asterisk; 34 COLOUR-EMOTION majority couples were found in COCA and COHA, 11 COLOUR-EMOTION majority couples were found only in COHA, only one COLOUR-EMOTION construction was found for BROWN with anger, and none were found with ORANGE.

Ranking per COLOUR	1	2	3	4	5
WHITE	fear	shock	rage	anger	fury
BLACK	anger	fury	hatred	rage	fear
RED	rage	embarrassment	anger	fury	shame
YELLOW	*fear**	*worry**	*mortification**	*jealousy**	*chagrin**
GREEN	envy	jealousy	hope	gloom	fear
BLUE	pride°	envy	*fear**	*envy**	*terror**
GREY	exhaustion°	remorse°	*fright**	*fury**	*terror**
BROWN	anger	---	---	---	---
PURPLE	rage	anger	passion	love	embarrassment
PINK	embarrassment	excitement	pleasure	enthusiasm	delight
ORANGE	---	---	---	---	---

Table 2: Five most common emotions listed per colour in COCA and COHA (*) and social emotions (°).

Considering the corpus results, it seemed best to formulate the construction query with [[TURN] [COLOUR] with], as the most prominent version of [X [BECOME] Y with Z]. Considering the average of both corpora TURN is the most frequently found verb in this construction. It is a salient and robust construction that takes on all the different grammatical forms. Both GO and GROW are prominent depending on which corpus was accessed. GO is second in ranking in COCA (used mostly with WHITE), and GROW is first in ranking in COHA and very close to TURN considering the average of both corpora (see Table 1). It appears that GO is used in a more informal register, and GROW is used in a more formal or archaic register.

The lexemes selected as representing emotions in the corpora were evaluated as involving emotion in a primary sense, questioning the inclusion of "emotional attitudes, traits, disorders, or plots" [22]. In which case the lexeme *exhaustion* may seem to be dubious choices, though it was predominant in relation to GREY, and could possibly come on as an emotional reaction. The lexemes like *embarrassment*, *shame*, *mortification* and *chagrin* found in the construction with specific colours may be defined as feelings, but are also listed as non-basic emotions or social emotions in Section 1.5.

The main point in this analysis was to see what emotion lexemes are tied to colour, be they basic or complex emotions, or be they "feelings characterised by emotion" [9], or feelings of emotion [21].

Usage-based informant COLOUR-EMOTION test analysis

This part of the research is based on three different questionnaires (Test 1, Test 2 and Test 3). They were administered to native English speakers. The structure of the three tests and the analysis of the results took place in the same manner. The differences are in the formulation of the questions. Test 1 and Test 2 prompted the candidate to connect an emotion to the given colour (one for each of the eleven BCTs), on the contrary Test 3 required the informant to associate a specific given emotion (one of fourteen selected) with a colour. The tests also included variation of the verb: *turned* vs *went/turned*, and of the subject: *they* vs. *I*. If the informant gave more than one answer, only the first answer was taken into consideration.

3.1 Test 1

Methodology and procedure

The first test questionnaire posed the question: "What emotion comes to mind with colours? *Black with ...*; *White with ...*", etc. for each of the eleven BCTs. 40 informants of the University of Washington in Seattle (USA) took part in the first test. The average age was 22. The group was made up of 27 females and 9 males. A paper questionnaire was distributed to the group. It took them less than 15 minutes to complete the test.

Results

The results were not homogeneous. The informants did not necessarily indicate an emotion. The initial generic query did not facilitate access to conventional constructions, thus the responses also included free associations to the colour terms. Nonetheless, the responses served to give a general idea of the wide range of COLOUR-EMOTION association patterns that are subjectively possible.

Ranking per COLOUR	1 emotion %	2 emotion %	3 emotion %	4 emotion %	5 emotion %
WHITE	emptiness 32	calmness 25	joy 14	clarity 11	hope 7
BLACK	**sadness 57**	anger 25	hate 3	shame 3	fear 3
RED	anger 45	love 21	passion 18	embarrassment 8	happiness 3
YELLOW	**happiness 69**	calmness 14	love 8	disgust 3	jealousy 3
GREEN	envy 39	calmness 18	excitement 14	happiness 7	disgust 7
BLUE	calmness 37	sadness 26	happiness 20	hope 11	excitement 3
GREY	**sadness 77**	boredom 17	calmness 3	despair 3	---
BROWN	boredom 37	disgust 18	sadness 11	uneasiness 11	tiredness 7
PURPLE	pride 48	calmness 10	happiness 9	anxiety 9	passion 9
PINK	happiness 31	love 23	energetic 17	excitement 11	calmness 6
ORANGE	energetic 30	happiness 29	excitement 15	calmness 7	anger 7

Table 3: Five most named emotion/feelings and percentage of informants listed per colour in Test 1.

Only the lexemes that were close to emotions-feelings were included in the analysis of the results. Some examples of outlier answers are: YELLOW – sun, infancy, BROWN – dirt, dog, BLUE – aqua, mystery, BLACK – death, formal. It became clear that many responses were metonymically related items. Only 72% of the responses corresponded to a generic definition of an emotion/feeling, and were evaluated in the results. The top five emotion/feelings per colour and the percentage of agreement are indicated in Table 3. It appears that the informant was not accessing an emotion for the COLOUR-

EMOTION construction, but was accessing the way the colour made the informant feel, or what the colour brought to mind. Only three COLOUR-EMOTION pairs showed a majority agreement (see bold print in Table 3).

It results from this first test that the colours associated with negative emotions are WHITE, BLACK, RED, GREEN, GREY and BROWN, and the colours related to positive emotions are YELLOW, BLUE, PURPLE, ORANGE, and PINK. A majority agreement exists for BLACK-*sadness*, YELLOW-*happiness*, GREY-*sadness*. All the other COLOUR-EMOTION couples have under 50% agreement, only GREY-sadness has over 70% agreement.

3.2 Test 2

Methodology and procedure

The second test questionnaire posed the question: "What emotion would you insert in this expression? They turned *black* with ...", etc., with one question for each of the eleven BCTs. Two groups of informants took part in the second test for a total of 35. One group was made up of native speakers living in Italy, and the other group was made up of adults attending a colour workshop in Seattle, Washington. The average age of the two groups was 45. It included 21 females and 14 males. The new form was distributed to each person individually. It took them less than 15 minutes to complete the test.

To formulate the Test 2 question, I chose *TURN* because it was the most prominent verb in the corpus analysis. It also seemed the most direct way to prime an experience or to direct the informant to access the COLOUR-EMOTION construction in memory, since it indicates the idea of "cause to change colour", i.e. transition from a given state to a different state caused by emotion/feeling. Furthermore, I opted to use the simple past *–ed* form to encourage the informant to relate to past experience. This test used the third person plural pronoun *they*, so as to avoid any reference to male or female associations that *s/he* would have caused.

Results

Only 74% of the responses corresponded to a generic definition of an EMOTION, and were evaluated in the results. The top five EMOTIONS per COLOUR and the percentage of agreement are indicated in Table 4. This test had six COLOUR-EMOTION pairs with a majority agreement (WHITE, RED, GREEN, BLUE, PINK and ORANGE); which are different to Test 1.

Ranking per COLOUR	1 emotion %	2 emotion %	3 emotion %	4 emotion %	5 emotion %
WHITE	**fear 71**	happiness 8	anger 6	sadness 6	boredom 6
BLACK	anger 35	sadness 24	disgust 21	fear 17	boredom 3
RED	**anger 70**	embarrassment 25	happiness 5	---	---
YELLOW	disgust 29	fear 26	envy 21	happiness 9	hope 9
GREEN	**envy 70**	disgust 18	hope 9	conviction 3	---
BLUE	**sadness 54**	coldness 31	conviction 10	happiness 7	---
GREY	boredom 36	fear 27	sadness 23	disgust 9	embarrassment 5
BROWN	boredom 38	disgust 13	happiness 13	embarrassment 12	conviction 6
PURPLE	anger 35	happiness 18	hope 18	conviction 13	sadness 4
PINK	**happiness 74**	embarrassment 22	hope 4	---	---
ORANGE	**happiness 61**	boredom 11	hope 6	fear 6	conviction 6

Table 4: Five most named emotions and percentage of informants listed per colour in Test 2.

In this case I grouped the subordinate EMOTION items, all listed here, according to the following ten basic EMOTIONS in keeping with [9,21-23,25]. *ANGER*: rage, fury, passion, fierceness, frustration; *CONVICTION*: arrogance, pride (royalty), bravado; *ENVY*: jealousy; SADNESS: gloom,

misery, grief, solitude, heavy heart, anguish, depression, melancholy, despairing, dismay, distress; *BOREDOM*: emptiness, fatigue, apathy, indifference, cold(ness); *DISGUST*: hate, guilt, sickness, illness, nausea; *EMBARRASSMENT*: shame, confusion, reluctance; *FEAR*: terror, shock, anxiety, impatience, cowardice, worry, uncertainty, indecision, suspicion; *HAPPINESS*: joy, cheer, delight, pleasure, love, sympathy, hilarity, mirth, glee, sanguine, elation, excitement, arousal, warmth; *HOPE*: anticipation, eagerness, hunger, desire, lust, vigor. Of the ten EMOTION categories five correspond to those presented in Section 1.5 (regular font). The additional five EMOTION categories (italics) specify emotions that were also named most frequently by the informants.

Data from Test 2 show that the colours associated with negative emotions are WHITE, BLACK, RED, YELLOW, GREEN, BLUE, GREY, BROWN, and the colours related to positive emotions are only PURPLE, ORANGE, and PINK. WHITE-*FEAR*, RED-*ANGER*, GREEN-*ENVY*, PINK-*HAPPINESS* had over 70% agreement, and BLUE-*SADNESS*, ORANGE-*HAPPINESS* had over 50% agreement. All the other percentages of agreement are under the majority.

3.3 Test 3

Methodology and procedure

Test 3 posed the expression: "*I went/turned ... with rage/fear*, etc."; one item for each of fourteen EMOTION categories. The categories were selected by putting together the most predominant emotions per colour from the corpus analysis (*rage*, *fear*, *embarrassment*, *exhaustion*, *excitement*) and the emotions that had the highest percentage of agreement in Test 1 (*anger*, *envy*, *sadness*, *boredom*, *happiness*, *love*, *passion*, *calmness*). All of these EMOTION categories were confirmed in Test 2. *Pride* from Test 1 was excluded due to the specific reference (see Section 3.1). *Cowardice* was added to test an archaic reference. Thirty-one informants took part in Test 3. They were all native speakers. The average age was 53, ranging from 22 to 84, and included 23 females and 8 males.

Test 3 employed the same procedure as the other tests, the significant difference being that the informant was asked to provide a colour term, rather than an emotion, to complete the utterance. Test 3 was structured with complete sentences to constrain the responses, and types of associations. Test 3, by contrast, was similar to Test 2 in the wording of the query sentences. The query changed to the first person singular "I" to prime a sense of subjective participation, even though it thus formulated an unusual utterance. Moreover, there was a choice between "went/turned", utilising again the simple past to access memory and experience. The verb "go" was included since it was second in ranking in the contemporary corpus analysis.

Results

Since Test 3 had fourteen items per questionnaire, this meant that some informants repeated a colour response, or indicated more specific colours than just the BCTs. Rarely the response was not a colour term, or the informant left the answer blank. 90.8% of the answers were evaluated in the results. In this sense it is important to emphasise that basic and subordinate levels of linguistic categorisation were used to analyse the data – similar to the division of the EMOTION categories. For the basic category YELLOW specific subordinate terms *canary yellow*, *golden*, *deep yellow* and *mustard yellow* emerged; for RED: *crimson* and *scarlet*; for PURPLE: *violet* and *lavender*; and for BLUE: *light blue*, *turquoise*, *aqua* and *cyan*. The informants used BCTs in 85% of the responses to the EMOTION construction. I propose that processing the colour construction triggers what Simmons calls "a valent embodied appraisal". The chromatic signal in memory via non-visual body response is accessed and applied according to the context [29].

Table 5 shows the colours with the "first ranking responses identified with the fourteen EMOTIONS, which represent seven of the eleven BCTs. They are: RED that is associated with *anger*

(74%), *rage* (53%), *embarrassment* (55%), *passion* (66%) and *excitement* (29%); BLUE with *sadness* (83%) and *calmness* (50%); YELLOW with *cowardice* (71%) and *happiness* (63%); GREY with *exhaustion* (50%) and *boredom* (48%); WHITE with *fear* (78%); GREEN in *envy* (87%); and PINK with *love* (52%). The remaining four BCTs are present in the association with the EMOTIONS, but to a lower degree in the "second ranking" group: BLACK (23% *anger*), BROWN (22% *boredom*), PURPLE (22% *rage*); and in "third ranking" group: ORANGE (11% *happiness*). Twelve of the fourteen COLOUR-EMOTION pairs showed a majority agreement; the only exceptions were GREY (48% *boredom*) and RED (29% *excitement*).

Ranking per COLOUR	1 colour %	2 colour %	3 colour %	4 colour %	5 colour %
RAGE	**red 53**	purple 22	white 13	black 12	---
FEAR	**white 78**	black 10	green 3	blue 3	yellow 3
ANGER	**red 74**	black 23	purple 3	---	---
COWARDICE	**yellow 71**	green 11	white 11	pink 4	brown 3
ENVY	**green 87**	yellow 7	orange 3	grey 3	---
EMBARRASSMENT	**red 55**	pink 42	purple 3	---	---
SADNESS	**blue 83**	grey 17	---	---	---
BOREDOM	grey 48	brown 22	white 15	blue 4	purple 4
HAPPINESS	**yellow 63**	pink 22	orange 11	blue 4	---
EXHAUSTION	**grey 50**	white 19	green 12	brown 11	orange 4
EXCITEMENT	red 29	pink 26	yellow 18	orange 11	purple 4
LOVE	**pink 54**	red 30	purple 10	white 6	---
PASSION	**red 66**	purple 17	orange 7	pink 3	black 3
CALMNESS	**blue 50**	white 11	pink 8	grey 8	purple 7

Table 5: The five most associated colours and percentage of informants listed per emotion in Test 3.

In Test 3 RED is the colour associated with the highest number of first ranking emotions. Yet PURPLE and PINK are the colours that were associated with the highest number of emotions, eight each. WHITE was associated with seven emotions, RED with six, YELLOW and BLUE with five, BLACK and GREY with four, and GREEN and BROWN with only three. There was a majority agreement for the emotion association with WHITE, RED (two associations), YELLOW, GREEN, BLUE (two associations), GREY, and PINK.

Discussion

Among the dictionary definitions of the lemma RED, the following appears: "having the face temporarily suffused with blood, being a sign of anger, shame, etc." [9]. Moreover, the expression "to see red" means "to become very angry, become enraged". It is clear that the connection of RED with emotions such as *anger-rage-embarrassment-excitement-passion* is due to the effect that such emotions create in the individual, including the physical result of the visible redness of the face due to an increased flow of blood. This process is motivated by and has become entrenched in the English language through the conceptual metaphor, e.g. ANGER IS A HOT FLUID IN A CONTAINER, and conceptual metonymy, e.g. EFFECT OF THE EMOTION FOR THE EMOTION - REDNESS IN THE FACE OR NECK AREA FOR ANGER or EMOTION IS A FORCE or HEAT [5,24,31]. In this same way the intensity of an emotion is marked by the darkness or lightness of the colours: BLACK and PURPLE vs. PINK and WHITE. The associations between YELLOW with *happiness* and *cowardice* seem to access different types of associations –CAUSE vs. EFFECT. The YELLOW object, the sun, causes *happiness*, but YELLOW bile is the effect of *cowardice*. The same with BLUE; the BLUE sky or sea causes a sense of *calmness*, and the BLUES are an effect of *sadness* and *depression*. BLACK, GREY and BROWN are lacking in colour and are thus associated with dark, desaturated, negative

emotions, *anger*, *exhaustion* and *boredom*. These pairs are motivated by the conceptual metaphors EMOTION IS A WEATHER PHENOMENON [5], GOOD IS LIGHT vs. BAD IS DARK [3,6]. And GREEN, like YELLOW, is perceived as an unnatural body colour, and felt to be a result of *illness* and *nausea*, and by metaphoric and metonymic extension of *sickness* with *jealousy* and *envy*, motivated by EMOTION IS AN ILLNESS [5].

It is significant to note that Ekman's sixth basic emotion [26] "surprise" was not found in relation to colour, neither in the corpus analysis nor in the three tests (see §1.2 and Table 4). Though *calmness* is frequently referred to as an EMOTION in Test 1, and was easily accessed in Test 3, and may be considered a "complex unconscious reaction" (see Section 1.5), in the same way that *boredom* and *cowardice* are. None of these three emotions, however, were found in the [X [BECOME] [COLOUR] with [EMOTION]] construction in the corpus analysis, yet a majority of the informants agreed on the colour association with these items.

Looking at the results of the three tests in Table 6, it becomes evident that it is easier to assign a colour to an emotion (Test 3) – possibly accessing what Simmons identifies as the route to emotion via cognitive appraisal [29], than to assign an emotion to a colour (Tests 1 and 2) – possibly accessing what Simmons identifies as a route to emotion via associated memory [29]. All of the COLOUR-EMOTION pairs in Test 3 have a majority consensus except for BLACK, BROWN, PURPLE and ORANGE. The highest ranking EMOTION with BLACK is *anger* 23%, with BROWN is *boredom* 22%, with PURPLE is *rage* 22%, and with ORANGE is *happiness* 11%. However, these are not the highest ranking COLOURS for these EMOTIONS; which are *anger*/RED 74%, *rage*/RED 53%, and *happiness*/YELLOW 63% (see Table 5).

COLOUR	Corpus	Test 1- colour given	Test 2- colour given	Test 3 - emotion given	
WHITE	fear	*emptiness 32%*	fear 71%	FEAR	white 78%
BLACK	anger	*sadness 57%*	anger 35%	ANGER*	black 23%
RED	rage, anger	anger 45%	anger 70%	ANGER, RAGE, PASSION	red 74%, 53%, 66%
RED 2	embarrass	embarrass 8%	embarrass 25%	EMBARRASS	red 55%
YELLOW	*fear*	*happiness 69%*	*disgust 29%*	*HAPPINESS*	yellow 63%
GREEN	envy	envy 39%	envy 70%	ENVY	green 87%
BLUE	*pride*	sadness 26%	sadness 54%	SADNESS	blue 83%
BLUE 2	*envy*	calmness 37%	coldness 31%	CALMNESS	blue 50%
GREY	*exhaustion*	sadness 77%	boredom 36%	EXHAUSTION	grey 50%
BROWN	*anger*	boredom 37%	boredom 38%	BOREDOM*	brown 22%
PURPLE	rage, anger	pride 48%	anger 35%	RAGE*	purple 22%
PINK	embarrass	happiness 31%	happiness 74%	LOVE	pink 54%
ORANGE	---	energetic 30%	happiness 61%	HAPPINESS*	orange 11%

*Table 6: Total results for top ranking association for each mode of analysis (Test 3 - * top ranking emotion association with the colour).*

It is clear, however, that the conventionality of some COLOUR-EMOTION construction pairs triggers the connection for the speaker. This study shows that there is a well-established entrenched conventional experiential association between certain COLOURS and EMOTIONS in the linguistic construction, while for others the link between COLOUR-EMOTION is based on more singular personal experiential factors, or on the particular contextual construal. Colour association accessed via saturation –purity– may depend on the intensity of the emotion interpreted by the speaker in the given context. There are COLOUR-EMOTION pairs that have a lower degree of conventionality, as surmised by the non-uniformity of the EMOTIONS or COLOURS given by the informants in the three tests and those found in the corpora.

Table 6 illustrates a parallel analysis of the two usage-based approaches that show different degrees of conventionality emerging in the COLOUR-EMOTION construction. The following may be evinced

considering the highest levels of consensus and ALL the results in Tables 3, 4, 5 and 6 (note the variation of percentage on agreement, ** marks a further ranking of the couple):

(1) All four means of analysis result in the same pairs: RED–*ANGER*; RED–*EMBARRASSMENT*; GREEN–*ENVY*.
(2) Three means of analysis result in the same pairs: WHITE–*FEAR*; BLACK–*ANGER*; BLUE–*SADNESS*; BROWN–*BOREDOM*; PURPLE–*RAGE*, PURPLE–*ANGER***; PINK-*HAPPINESS***.
(3) Two means of analysis result in the same pairs: RED–*PASSION***; YELLOW–*HAPPINESS*; BLUE–*CALMNESS*; GREY–*EXHAUSTION*, GREY–*BOREDOM***; PINK–*LOVE***; ORANGE–*HAPPINESS*.
(4) The COLOUR-EMOTION pairs that emerge in Test 3 are also confirmed by dictionary.com: RED–*EXCITEMENT*; YELLOW–*COWARDICE*.

Every COLOUR paired with an EMOTION in a couple of the modes of analysis at different ranking levels. It is interesting to note that the BCT's take on positive and negative connotations depending on the association, the accessing direction, and the imagined context.

The COLOUR-EMOTION pairs are similar to the previous studies: *happiness* light and saturated colours, and *fear* lightest desaturated colour; *anger* and *disgust* darkest colours; *sadness* intermediate lightness and desaturated colour; *boredom* and *exhaustion* desaturated; intense emotions like *happiness*, *anger* and *envy* are more saturated colours [5,28-29]. The only differences found with Steinvall's corpus analysis are [5] BLUE – *joy* and *happiness*, GREY, BLACK – *sadness*, GREEN, BROWN – *anger*. He had no results for *boredom*, *exhaustion* or *calmness*. Interestingly he had the same null results for *surprise*, and he also found the dual results for YELLOW and BLUE, and RED for *passion* and *excitement*. Steinvall's corpus analysis results found: more RED for *love* than PINK, and more PINK for *excitement* than RED [5]; my results were inverted. The results, however, went beyond the historical humoral colour associations, such as BLACK – melancholic (sadness), YELLOW – choleric (envy), RED – sanguine (cheerful), BLUE – phlegmatic (calm); though they are definitely discernable within the multiple associations.

Conclusions

Analysis of these results indicates the existence of a high degree of conventionalised colour constructions in English. Accessing the emotion through the colour did not give the same access to the construction, and the associations given were related to particular personal experiences, objects, or states of being rather than specifically emotions. This lent for the need of a complex categorisation process to proceed with the conceptual analysis. Conventionalised colour constructions refer to the fact that the linguistic expressions are preset and fixed in the minds of the speakers. They are not created online every time production or interpretation of a certain expression happens (e.g. metaphors, metonyms, and idiomatic expressions), since they are motivated through correlations in conceptual embodied experience. All conventions must be mentally represented somehow; otherwise people could not access the meaning with such ease [32].

EMOTION positivity or negativity is related to the colour dimensions; brightness/lightness and saturation both play an essential function. Two conceptual metaphors, that establish cognitive models, motivate this type of conceptualisation: MORE INTENSE EMOTION IS DARKER OR MORE

SATURATED COLOUR (e.g. *Her eyes turned black with hatred*; *He turned crimson with rage*) and LESS INTENSE EMOTION IS LIGHTER OR LESS SATURATED COLOUR (e.g. *Sarah turned pink with embarrassment*; *Diane's face was grey with exhaustion*). These two new cognitive models join the basic conceptual metaphors and metonyms necessary to conceptualise COLOUR and EMOTION: THE BODY IS A CONTAINER FOR EMOTIONS, CHANGE IN FACE COLOUR FOR THE EMOTION, EMOTION IS A FORCE [HEAT], EMOTION IS ILLNESS, EMOTION IS A WEATHER PHENOMENON, COLOURS ARE ENTITIES, and COLOURS ARE LOCATIONS.

This paper highlights the concept of embodiment, which is central to understanding emotion and colour experience, as linguistic evidence suggests. Emotion concepts are based on our sensory perception of colour lightness and darkness, saturation, and also temperature [3,5,6,29]. COLOUR–EMOTION associations are grounded in bodily experience as they are correlated between sensorimotor and subjective understanding. People appear to have very similar ideas about their bodies and to see themselves as undergoing the same physiological processes when they experience an emotion [32]. The couples of COLOUR–EMOTION associations are conceptualised through metaphor and metonymy that have roots in embodied experiences, though the COLOUR association is variable as the construal of a given situation may be different according to the individual perspective.

Returning to the initial questions, this research argues that the relationship of the COLOUR-EMOTION construction [X [BECOME] [COLOUR] with [EMOTION]] is definitely well entrenched for English speakers, though less frequent than imagined in the corpus and with more variable COLOUR-EMOTION couples than expected. The frequency of its use is less in contemporary English than in historical English corpora. Priming these constructions is accessed more directly via emotion, though it varies according to contextual constraints. Further investigation of the COLOUR–EMOTION association would seem due, utilising other specific emotion categories, e.g. *disgust* and *surprise*.

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Glossary

FRAME: A *semantic frame* as described by Charles Fillmore [1] is “any system of concepts related in such a way that to understand any one of them you have to understand the whole structure in which it fits; when one of the things in such a structure is introduced into a text, or into a conversation, all of the others are automatically made available” p374, or when considering how, “the notion plays a role in the description of linguistic meanings, [it] is a system of categories structured in accordance with some motivating context”, p381. This paper discusses the interface between COLOUR and EMOTION, two frames that come together when we try to describe a specific emotion with an attribute.

EMBODIMENT: Embodied cognition, or embodiment, emphasises the role that the body plays in shaping the mind and language. This notion has several different definitions; I adopt Gibb’s [33] general definition of what he calls the ‘embodiment premise’: “people’s subjective, felt experiences of

their bodies in action provide part of the fundamental grounding for language and thought. Cognition is what occurs when the body engages the physical, cultural world and must be studied in terms of the dynamical interactions between people and the environment. Human language and thought emerge from recurring patterns of embodied activity that constrain ongoing intelligent behavior," p9. Thus we may evince that the embodied constraints include also our cognitive constraints in establishing the semantic frames we use to orient ourselves in the understanding and production of language. Our embodied experience of the two frames allows us to use colours to reference a specific aspect of a given emotion.

CONSTRUCTION: As defined in Construction Grammar, a strand of Cognitive Linguistics, a construction is the conventional unit pairing of meaning with form that leads us from a mental representation to a lexical concept with which it is then associated [12,17,18]. Humans use what are recognised as linguistic constructions that are stored in long-term memory to facilitate language production and language comprehension [18]. Or more precisely a linguistic *construction* is "the parings of forms and meanings such that the form automatically evokes the meaning and vice versa" [31] p246. Or we could say that "constructions which correspond to basic sentence types encode as their central senses event types that are basic to human experience" p39 [34]. The construction involved in this study is [X [BECOME] Y with Z].

CONCEPTUAL METAPHOR: A conceptual metaphor is made up of an abstract target domain A, e.g. COLOUR, that is understood in terms of a concrete source domain B, e.g. ENTITY or LOCATION, manifested in: COLOUR IS AN ENTITY and COLOUR IS A LOCATION [20]. Kövecses [31] explains that the "understanding is achieved by seeing a set of systematic correspondences, or mappings, between the two domains" p324. He illustrates conceptual metaphor A IS B with LIFE IS A JOURNEY, which would manifest an expression like "He had a head start in life". Lakoff and Johnson [20] argue, and this paper endorses their approach, that "conceptual metaphor is pervasive in everyday life, not just in language but in thought and action" p3, " the locus of metaphor is in concepts not in words, [...] it is typically based on cross-domain correlations in our experience, [...] and the system of conceptual metaphors is not arbitrary or just historically contingent; rather it is shaped to a significant extent by the common nature of our bodies and the shared ways that we all function in the everyday world" p244-245.

CONCEPTUAL METONYMY: "Conceptual metonymy is a cognitive process in which one conceptual entity, the vehicle, provides mental access to another conceptual entity, the target, within the same conceptual domain, or idealised cognitive model. In metonymy, both the vehicle entity and the target entity are elements of one and the same conceptual domain" p324 [31]. The syntax for conceptual metonymy is A (IS ACCESS) FOR B. For example, "She was *scarlet with rage*" and "He got *red with anger*" are the manifestation of REDNESS IN THE FACE AND NECK AREA (IS ACCESS) FOR ANGER, or more specifically THE EFFECT (IS ACCESS) FOR THE CAUSE p205-209 [31].

According to how we fill the slots in a given construction, we have linguistic expressions that may be considered more *literal*, e.g. "I had *become* friends *with* Maria", or metonymic, e.g. "Kelly felt her face *turn* red *with* embarrassment", or more obviously *metaphoric*, e.g. "Other women took one look at them, and *went* green *with* envy". However, these three utterances are based on the conceptual metaphor CHANGE IS MOTION (*become*, *turn*, *went*), and COLOUR IS AN ENTITY (*turn* red) or COLOUR IS A LOCATION (*went* green) [3], [20], and on the conceptual metonymy THE COLOUR (IS ACCESS) FOR THE EMOTION.

COGNITIVE MODEL: Idealised cognitive models, or simply cognitive models, are structured conceptual representations of domains in terms of elements of these domains p326. The conceptual domain is our conceptual representation, or knowledge, of any coherent segment of experience p324 [31].

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