

Plutchik's Wheel and The Unity of Opposites

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Abstract

Using the principle of the Unity of Opposites, the Plutchik's wheel of emotions is converted into the „vortex“ model, whereby the most gentle emotions are inside of the wheel, whereas the rudest are outside. This relates emotions to a wide variety of seemingly unrelated phenomena (such as physical force fields, color theory, personality traits, sleep – wake cycles, schema therapy, morality, and intellectual performance), but also casts doubts on the existing emotion scales. Each scale (such as intensity and valence) should be of two types, “external” and “internal”, distinguishing between the “superficial” and “eternal” parts of a given state. Emotion awakens (arousal) appears to depend not only on the sleep-wake cycles, but also on our general behavior. All of this calls for a better system motivating us to live more naturally, seek more subtle inner states, and become wiser.

Keywords: Emotions, Unity of Opposites, Plutchik, Morality, Wisdom, Circumplex

More than a millennium ago, Aristotle taught us how to rule people by manipulating their emotions (Roberts, 1924). According to his teaching, in every situation we are driven by two opposite emotions (*e.g.*, Anger – Calmness, Fear – Confidence, etc), and it is up to the ruler to decide which side will take the lead. But Aristotle did not teach us how to unite these oppositions into something “more stable and independent”, so that we could live happily without any rulers. In fact, most (if not all) philosophers who dealt with the Unity of Opposites (McGill et al, 1948, Wardy, 2002, Sun, 2009, Henderson, 2010, Graham, 2019) considered mostly the “struggle of oppositions”. The “unification” part – that was dealt with in many “positive” spiritual traditions (Groff et al, 1996) – was mostly “left behind”. The concept of the “struggling oppositions” gave rise to various circumplex models (Plutchik, 1997a, Plutchik and Conte, 1997b). Yet none of these models tackle the question of how two (or more) oppositions could unite. In the meantime, this unification does really happen, as we (positively) change our attitudes, thoughts and actions.

More than a century ago William James (1890) exclaimed: „the greatest discovery of my generation is that a human being can alter his life by altering his attitudes“. Indeed, our attitudes control our emotions through cognitive appraisal (Cannon, 1927; Schachter et al, 1962; Lazarus, 1984; Dalgleish, 2004; Roseman et al, 2001, Scherer et al, 2001, 2009), and are in reciprocal relation with our thoughts and actions (Strongman, 2003), as well as morality (Ben-Zeev, 1997, Tangney et al, 2007) and worldviews (Koltko-Rivera, 2004). In this work I propose a simple scheme of how two opposite emotions can unite, and show how this can influence our morality, worldviews, and intellectual performance. It may also influence our understanding of what emotions are and facilitate their control in various practical situations. In pursuing this, I start with overviewing (some of) the existing theories of emotion in an attempt to generalize them and link to the principle of the Unity of Opposites.

Prevailing Theories of Emotion

Many theorists considered that all emotions arise from a small set of some “basic emotions” (Table 1).

Table 1. *Some Sets of Basic Emotions*

Author	Negative Emotions			Positive Emotions	
Aristotle (Roberts, 1924)	Anger, Fear Enmity, Envy		Pity, Shame	Friendship	Kindness Calm Confidence
Book of Rites (1 st cent. AC)	Anger, Fear	Sadness, Disliking		Liking	Joy Love
Descartes (1649)	Hate	Sadness		Wonder, Desire	Joy Love
James (1890)	Rage Fear	Grief			Joy Love
Plutchik (1958)	Anger Fear	Sadness, Disgust		Anticipat Surprise	Joy Acceptance
Tomkins (1962)	Anger Fear	Distress Disgust	Shame	Interest Surprise	Joy Contempt
Ekman (1972)	Anger Fear	Sadness Disgust		Surprise	Joy
Izard (1971)	Anger Fear	Distress Disgust	Guilt Shame	Interest Surprise	Joy Contempt
Russell (1980)	Angry Miserable	Depressed Distressed Sleepy		Excited	Pleased Relaxed
Oatley (1987)	Anger Anxiety	Sadness Disgust			Happiness

This view was “legitimized” by suggestion that each emotion is triggered by a distinct neural mechanism (Tomkins, 1962). Yet so far none of such mechanisms was proven to exist (Mauss et al, 2009, Barrett et al, 2017a, 2017b, Celeghin et al, 2017). In 1999 Ekman expanded his set by adding 11 more emotions. Richard and Bernice Lazarus (1996) suggested a list of 15. HUMAINE database (Douglas-Cowie et al., 2011) lists 48 emotions, Smith (2015) lists 154. It was also suggested that the number and type of “basic” emotions depends on our culture (Parkinson et al., 2005, Richeson, 2005), semantic articulation (Bann et al, 2014) and language that we use (Lindquist et al, 2015). Many studies showed that basic emotions can freely mix to produce intermediate states (Plutchik, 1980; TenHouten, 1996; Turner 2000; Athar et al, 2011). Cowen et al (2017, 2019) captured 27 emotion categories interrelated by smooth gradients of intermediate states, demonstrating that all emotions are fundamentally the same, forming a “unified continuum”.

A similar continuum was also proposed more than a century ago by Wundt (1897), who suggested that all emotions differ only by their positioning on three bipolar coordinates: pleasantness – unpleasantness, arousing – subduing, and strain – relaxation. These coordinates remain widely accepted up to date, although often under different names (Table 2).

Table 2. *Examples of Names Assigned to Major Scales of Emotions*

Author	Desirability	Intensity	Awakeness	Other
Wundt (1897)	Pleasantness - Unpleasantness	Strain - Relaxation	Arousal - Subduing	
Schlosberg (1954)	Pleasantness - Unpleasantness	Attention - Rejection	Activation - Sleepiness	
Osgood et al (1957)	Pleasantness - Unpleasantness	Calm – Excited ^{a)}	Dominance - Submission ^{a)}	

Yik et al., 1999	Valence	Tense - Calm	Awake - Tired	
Schimmack (2002)	Valence	Tense Arousal	Energetic Arousal	
Fontaine et al (2013)	Valence	Arousal ^{a)}	Power / Control ^{a)}	Novelty
Trnka et al (2016)	Valence	Intensity	Controlla- bility ^{a)}	Utility

^{a)} Arousal and Dominance are similar to Intensity and Awakeness, respectively

While Valence is generally accepted without a question, the Arousal and Intensity are often interchanged, as one of them is considered redundant (Yik et al, 1999). This causes much confusion, as they measure different effects. While Arousal is the state of being awoken, reflecting how energized or soporific one feels (Mehrabian, 1980), Intensity is the strength of internal strain. For example grief and depression can be low arousal, but high intensity feelings (Mehrabian, 1980). Furthermore, arousal was shown to depend on circadian rhythm (Schimmack, 1999; Thayer, 1989; Watson et al., 1999), whereas intensity is independent of it. Arousal is a better predictor of subject's cognitive performance (Matthews et al, 1994; Heller et al, 1997; Matthews et al, 2001).

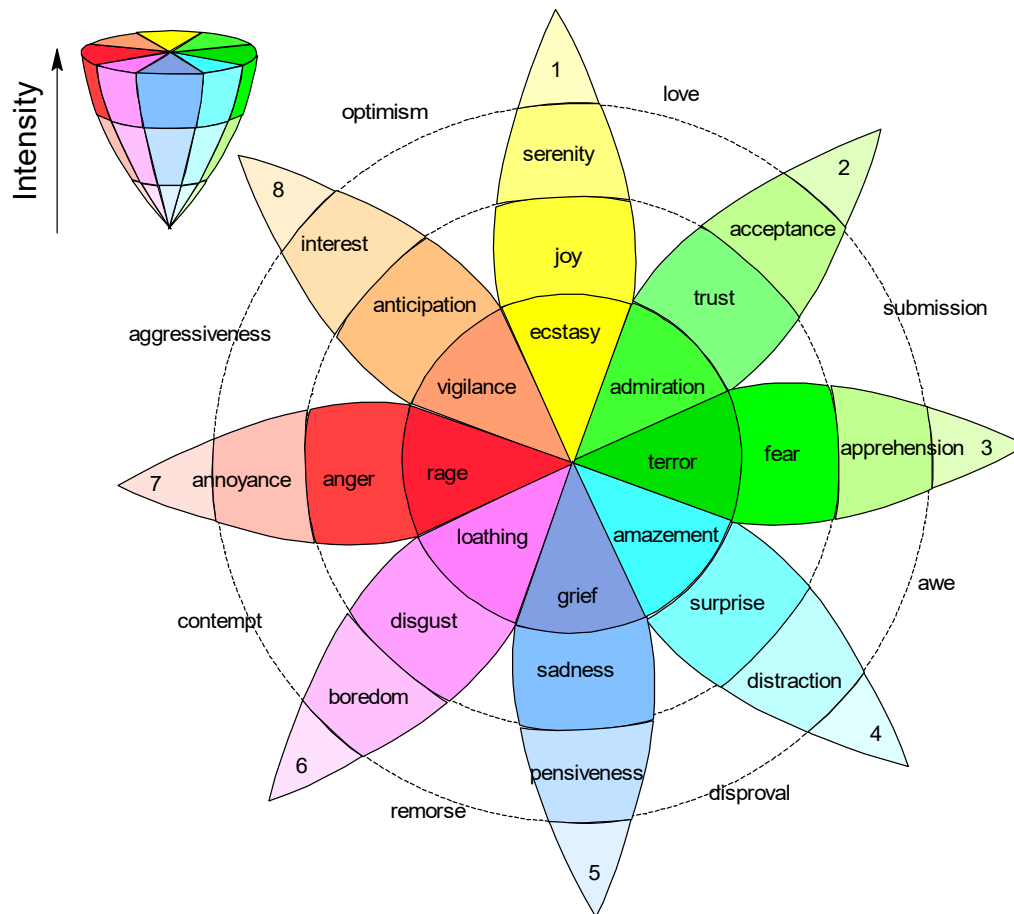
On the other hand, both scales are subject to large interpersonal variations (Yik et al., 1999). Osgood et al (1957) introduced the VAD (Valence – Arousal – Dominance) theory that further complicated situation. It was then developed by Russel and Mehrabian (1977), and used by others to index thousands of English words (Bradley and Lang, 1999; Mohammad. 2018). But the obtained values of Arousal and Dominance are highly correlated, and for many words Arousal resembles to the Wundt's Intensity (as will be shown below), whereas Dominance can be compared to the Wundt's Awakeness. Sometimes Dominance is replaced by two new variables, e.g., Controllability – how much a given emotion influences our thinking or behavior, and Utility

– how much we perceive that it is harmful or beneficial (Trnka et al, 2016). Both of them may change in time, as no matter how difficult it is to control any given emotion, there is always a hope that the next time we will do a better job. Thus, although Dominance was supposed to measure cognitive appraisal and control, it is time-dependent by itself. This concerns the scales of pleasantness and usefulness as well: what is useful and pleasant for a youngster, may be useless and unpleasant for an elder (and *vice versa*). All of this suggests that emotions may have some additional features that we are not aware of.

Circumplex Models

Circumplex models shift focus from individual emotions to their mutual interactions. Basic emotions are arranged into a circle, so that the most similar emotions occur next to each other, whereas the most dissimilar (opposite) occur furthest from each other (Plutchik et al, 1997a, 1997b). It stems from the century-old proposal of McDougall (1921) that emotions are similar to rainbow colors that follow a (more or less) strict order of arrangement. Like colors, basic emotions can also mix to produce “secondary” states, potentially leading to many different circular arrangements. Yet Schlosberg (1941, 1957), Plutchik (1958, 1980) and Russell (1980) all arrived at more or less similar arrangements. Perhaps the best known is the wheel of Plutchik (1958, 1980), which is shown on Figure 1. It arranges 8 basic emotions into 4 bipolar scales, each uniting two opposite petals that balance each other. For example, Joy is balanced by Sadness (petals 1 and 5). If Joy comes as an external trigger, then the Sadness petal must provide an internal response, creating certain stability and existential meaning.

Figure 1. Plutchik's Wheel of Emotions



On the other hand, Table 3 shows that different models suggest different balancing pairs. Take for example fear (in blue font): Aristotle balanced it with confidence, Plutchik with anger, others with contempt, calm and enchantment. Clarifying the meaning of these disparities is where the principle of the Unity of Opposites can be most useful (as will be shown below).

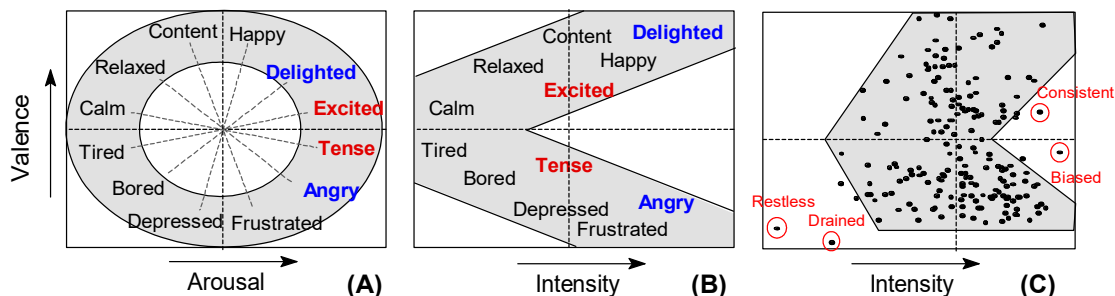
Table 3. *Comparison of Some Bipolar Scales*

Aristotle (4th BC)*	Schlosberg (1954)	Plutchik (1958)	Russell (1980)	Kort et al (2001)
Kindness – Unkind.	Happiness – Anger	Joy – Sadness	Happy – Depressed Content – Frustrated	Euphoria – Frustration
	Surprise – Disgust	Surprise – Anticipat	Excited – Tired Delighted – Bored	Encouraged – Dispirited Fascination – Boredom
Anger – Calmness Fear – Confidence	Anger – Love, Mirth Fear - Contempt	Anger – Fear	Angry - Relaxed Tense – Calm	Terror – Enchantment
Enmity - Friendship	Disgust - Surprise	Disgust – Trust		
Shame – Shameless.	Suffer - Contempt		Distressed - Relaxed	Anxiety – Confidence Humiliation – Pride

* From (Roberts, 1924), additional pairs involve Pity – Indignation, Envy – Emulation

Another open question is how to relate these circumplex models to various scales of emotions. Schlosberg (1954) plotted his circumplex model in 3D space, implicitly suggesting that valence is related to both intensity and arousal (although instead of intensity he used the attention – rejection scale). Russell (1980) plotted his circumplex model on a valence – arousal plane, suggesting circular relationship between these two scales (Figure 2, A, showing only 12 of 28 his considered emotions). This plot however caused controversy, as other authors assumed arousal to be essentially the same as intensity, and obtained pattern similar to plot (B).

Figure 2. (A) *Circumplex Model by Russell (1980)*. (B) *PANA and Vector Models (Rubin, 2009)*.
(C) *PCA Analysis of 197 Emotions (Liu et al, 2018)*



The latter gave rise to the “PANA” (Positive Activation – Negative Activation) model (Watson et al, 1985) and “vector” model (Bradley et al, 1992). Plot (B) assumes that at the highest point of intensity / arousal we feel ourselves either very good or very bad, whereas plot (A) suggests that we remain indifferent. Bradley et al (1999) showed a very clear V-shaped plot for nearly one thousand English words. Rubin (2009) compared both methods using the ratings of 30 major emotions and concluded in favor of plot (B). Kuppens et al (2013) specifically studied dependence of valence on arousal in 8 data sets and concluded that there is a weak but consistent V-shaped relation (plot B). Lastly, the machine learning and subsequent PCA analysis of nearly 200 emotions from millions of tweets (Liu et al, 2018) yielded plot (C), which also speaks in favor of (B). Yet many authors continue to refer to plot (A) and various its modifications (where emotions are scattered over entire plane), assuming that arousal equals to intensity.

Vortices of Emotions

The essence of the classic principle of the Unity of Opposites is that the opposites unite only when they are „desirable“ to each other. Each opposition has to be softened to a certain level, which usually requires a „mediation effort“. Consider for example two primordial elements, Fire and Water. In a usual („harsh“) form they just extinguish each other, manifesting the

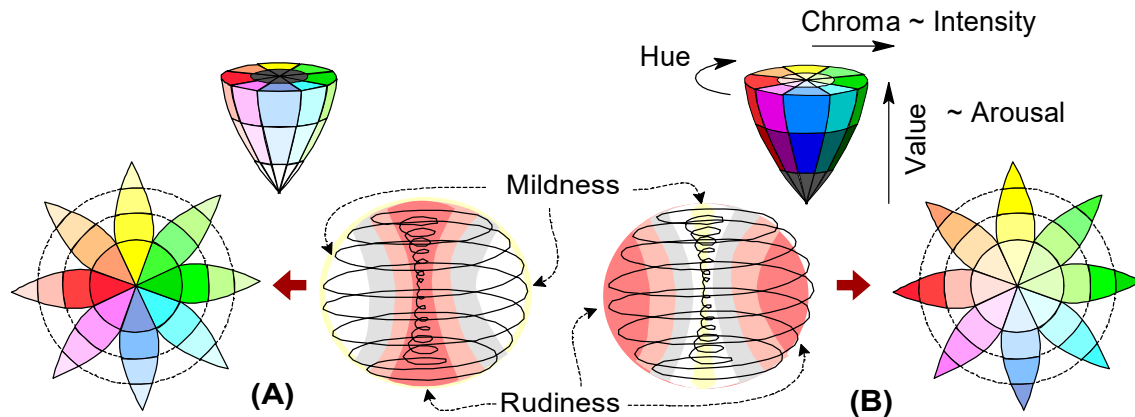
philosophical „struggle“ of oppositions. But if they are mediated by the 3rd element (Earth), then fire and water may become warmth and moist, respectively, that in concert create conditions for the life on Earth. The trick is in the „subtlety“ of their forms. If oppositions are soft and gentle to each other, they may unite, like mom and dad, giving birth to children. On the contrary, if they are harsh and rude, they can hardly coexist together. So is with emotions.

Consider Joy and Sadness from the Plutchik's wheel (petals 1 and 5 in Figure 1). When in struggle, they push themselves into their harshest forms – Ecstasy and Grief – that cannot coexist. But when they unite, they lift each other into their mildest forms – Serenity and Pensiveness, that create a gentle yet stable gladness. From dialectical point of view, this path should never end, as Serenity can further transform to even softer Blissed Fullfilment, whereas Pensiveness can become Profound Wisdom. The increasing gentleness and exquisiteness allow us to deal with ever increasing depth of existential questions, and the life becomes infinitely meaningful. (This is why this principle is widely employed by all spiritual traditions! See Groff et al, 1996.) Mediation of such development should fall on „neutral“ pair of emotions that is rotated orthogonally to the uniting pair. Yet Plutchik's wheel does not showcase this effect, as corresponding petals (3 and 7) contain only negative emotions.

To fix the situation, the original wheel should be first inverted inside out, so that the mildest forms should appear in the center (where they can unite), whereas the harshest forms should become furtherst from each other (as they cannot coexist). This is how the physical vortices work (Figure 3): the very center of whirlpools and hurricanes preserves tranquility (case B, yellow kernel), but the edges are fast-moving and destructive (reddish borders closer to equator). Case B is also more compatible with 3D color order systems (Nemcsics at al, 2015),

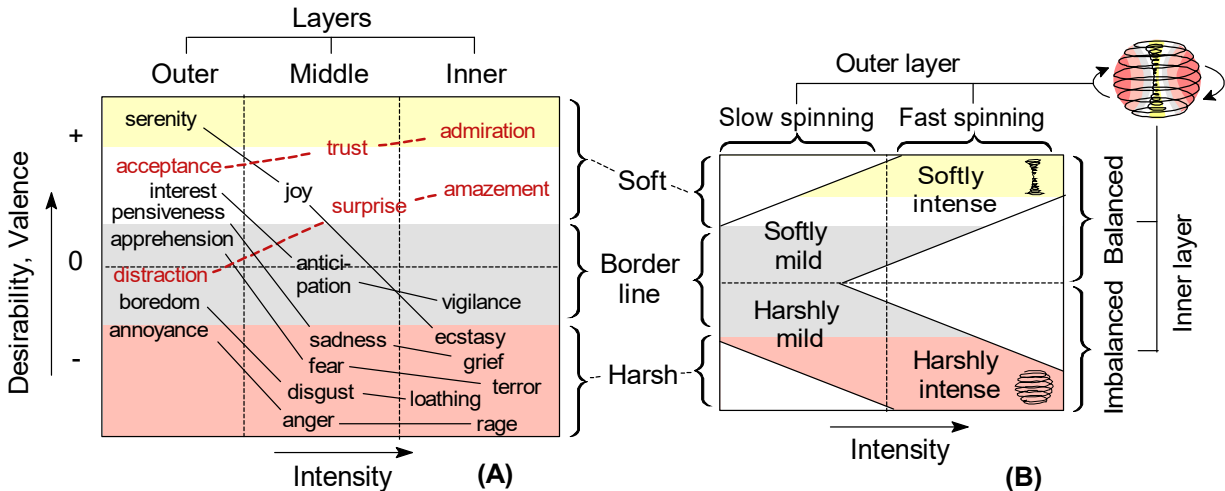
whereby emotion's intensity and arousal become comparable to the color's intensity (chroma) and brightness (value), respectively.

Figure 3. *Inversion of the Plutchik's Wheel (A) to the Physical Vortex Wheel (B)*



Such inversion is not straightforward however, as the original wheel disregards the desirability / valence of emotions that enables their unification. Balanced emotions in the center of the wheel should be also more desirable, but the original wheel makes it impossible. Figure 4(A) shows the dependence of emotions' desirabilities on their distance from the center of wheel. (Here and below desirability indicates the ability to form a „lasting unity“, as opposed to „superficial pleasantness“ that eventually leads to struggle.)

Figure 4. (A) *Distribution of Emotions from Plutchik's Wheel.* (B) *Explanation Using a 2-Compartment Spining Whirl*

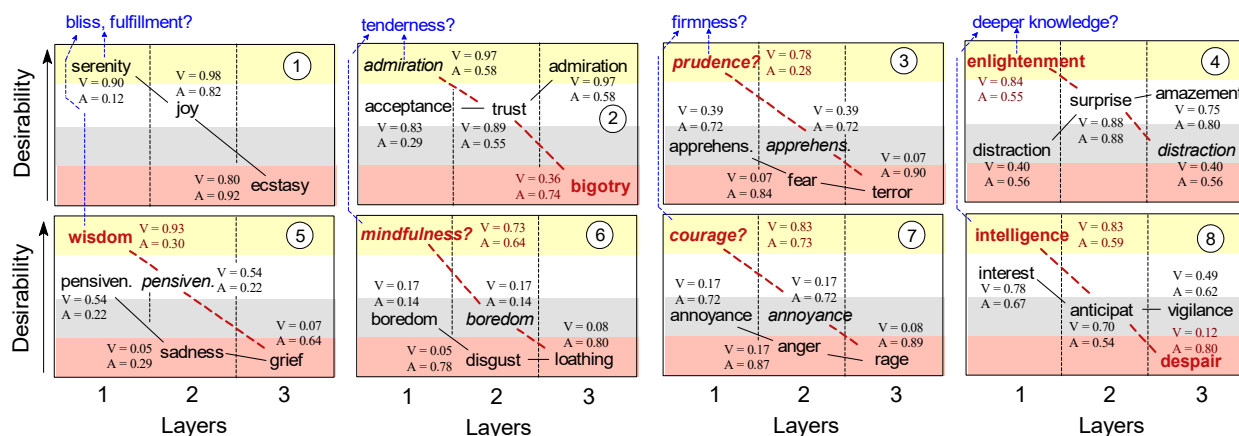


Emotions of the same petal are connected by straight lines. Moving from the outer layer towards the center, all lines go down, but two (dashed bordeaux) go up. The latter trends may not be immediately obvious, as for example pragmatic people put Trust higher than Admiration. But visionary people put Admiration higher, as (i) it is impossible to admire without trusting, and (ii) life would become meaningless after achieving full trust and finding out that there is nothing more after it.

The two types of trends in Figure 4(A) correspond to the two types of vectors showcased by the NAPA / Vector model in Figure 2(B). One vector goes up, reflecting the increasing desirability / valence of emotions („soft intensity“), another goes down, reflecting the decreasing desirability („harsh intensity“). Figure 4(B) explains this in terms of „local vortices“ within a global vortex of entire wheel. Each emotion can be viewed as a mini-whirl, where the inner kernel can be either balanced or not, and the outer layer can spin either slowly or quickly. A

balanced whirl may spin fast, but look as if it was not spinning at all. Yet if one tries to disturb it, it will resist due to the moment of inertia. On the contrary, the unbalanced whirl may spin slowly, but look turbulent and terrifying. If one tries to disturb it, it may react abruptly, but with smaller persistence. So the true admiration is silent, but eternal, whereas the false acceptance is loud, but short living. Sometimes turbulence is perceived like suppression rather than agitation, *e.g.*, in the case of terror or grief, yet they are also short-living compared to their balanced states, prudence and wisdom. So the balanced mini-vortices are more similar to character strengths rather than emotions, whereas the imbalanced ones express our „physiological“ reactions to unwanted situations. Accordingly, the inner layer of the wheel (after inversion) should only contain the balanced strengths and virtues, whereas the outer layer should consist of uncontrolled reactions („sins“). Figure 5 shows how this can be achieved. Each plot represents a certain petal, and all petals are grouped into pairs of oppositions. Numbers near each word indicate its valence (V) and arousal (A) from compilation of Mohammad (2018). Very roughly, they correspond to our Desirability and Intensity, respectively, although there are clear discrepancies as well.

Figure 5. *Adjusting to the Principle of Uniting Opposites.*



Continuous black lines unite the original emotions of a given petal, dashed bordeaux – adjusted. The letters show that desirability of emotions was made to continuously decrease by either moving one emotion to a new location (italic font) or adding new emotion(s) to appropriate layers (red font). Most of newly added emotions are personality traits (e.g., Prudence, Mindfulness, etc), but the distinction between emotions and traits is vague, and the language of mixed emotions is identical to the language of personality traits (Plutchik, 1980, 1997a). The validity of some traits may also be questioned due to their far extrapolation from original values (red italic with question marks), yet they are logically related to the corresponding traits from the opposite petals. Blue text above the plots suggests possible further direction of their growth. The overall result is that the entire wheel can now be inverted in accordance to Figure 3(B).

Merging adjacent petals and inverting the wheel

The wheel of emotions is often praised for showing how two adjacent emotions merge into intermediate states. Table 4 lists such mergers for the original and adjusted emotions from Figure 5 (2nd layers). Different color backgrounds indicate different desirability and softness. Although the more desirable effects are more difficult to describe (because of their exquisiteness), it is clear

that they also produce some intermediate states. Cowen et al (2019) predicts somewhat different states, but in fact they are more complimentary to our predictions than contradictory. Figure 6(A) gives examples of similar intermediate states for the four levels of subtlety. Here „primary“ emotions are located in the segments with odd numbers, „secondary“ – with even numbers. One can see that there is no principal difference between these two groups, as any two adjacent segments with even numbers (2+4, 4+6, ...) produce intermediate states with odd numbers (1, 3, ...). So every emotion is just an average of its closest neighbors,

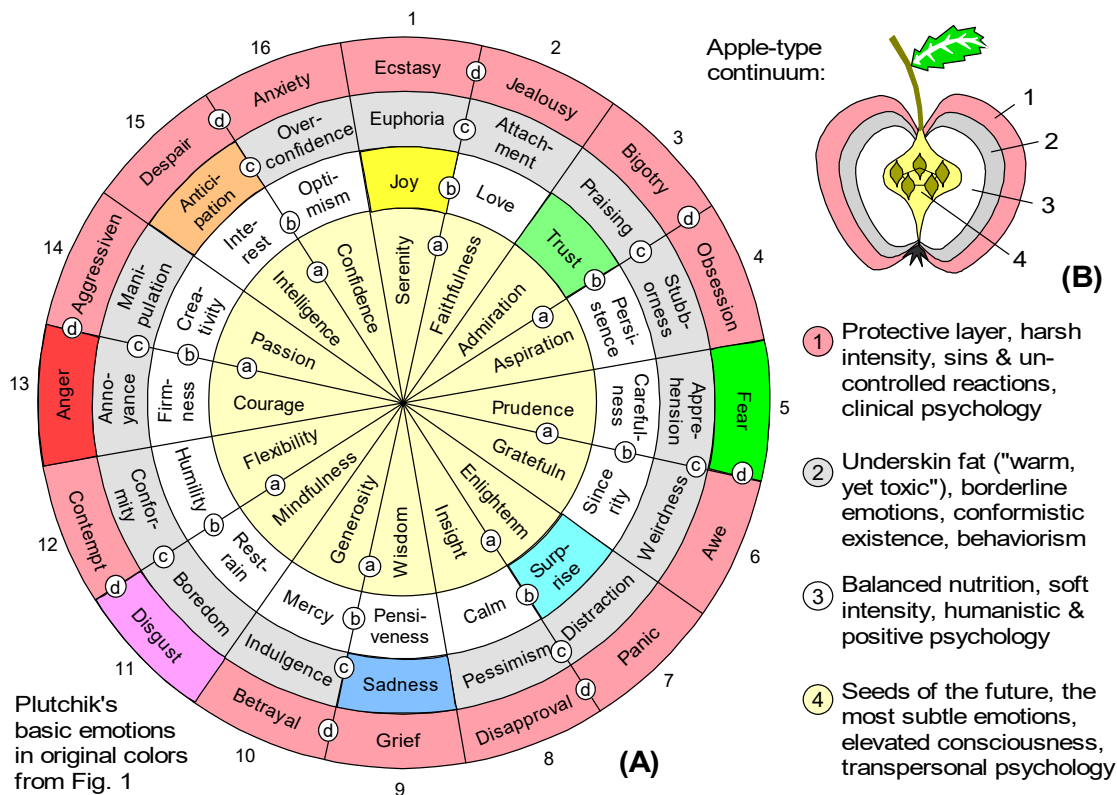
Table 4. *Adjacent Mergers for the 2nd Layer*

Petals	(A) Plutchik's Wheel	(B) Adjusted wheel
1+2	Joy + Trust = Love ^{a)} (Gladness) ^{b)}	Joy + Trust = Love ^{a, c)} (Gladness) ^{b)}
2+3	Trust + Fear = Submission ^{a)} (Sense of Narrow Escape) ^{b)}	Trust + Apprehension = Persistence ^{c)} (Grudging Respect) ^{b)}
3+4	Fear + Surprise = Awe ^{a)} (Fearful Awe) ^{b)}	Apprehension + Surprise = Weirddness ^{c)} (Alarm) ^{b)}
4+5	Surprise + Sadness = Disapproval ^{a)} (Sad Surprise) ^{b)}	Surprise + Pensiveness = Calm ^{c)} (Mystification) ^{b)}
5+6	Sadness + Disgust = Remorse ^{a)} (Sad Disgust) ^{b)}	Pensiveness + Boredom = Indulgence ^{c)} (Indifference) ^{b)}
6+7	Disgust + Anger = Contempt ^{a)} (Extreme Disgust) ^{b)}	Boredom + Annoyance = Conformity ^{c)} (Antipathy) ^{b)}
7+8	Anger + Anticipation = Aggressiveness ^{a)} (Envy) ^{b)}	Annoyance + Anticipation = Manipulation ^{c)} (Impatience) ^{b)}
8+1	Anticipation + Joy = Optimism ^{a)} (Giddy Anticipation) ^{b)}	Anticipation + Joy = Optimism ^{a, c)} (Giddy Anticipation) ^{b)}

^{a)} Adopted by Plutchik (1980). ^{b)} Adopted by Cowen et al (2019) and

www.alancowen.com/emotion-search. ^{c)} Adopted in this work

Figure 6. (A) *The Adjusted Wheel With Intermediate States in all Layers.* (B) *Distribution of the Soft and Harsh intensities Resemble Apple's Layers*



suggesting that the whole wheel is an indivisible continuum (in accord to the dimensional theory). This continuum produces emotions similar to how a global whirlpool produces local turbulences when triggered by external factors: it responds by activating the opposite side of the wheel, whereby the final result depends on its overall stability. The closer to the center of the whirlpool, the smaller external power and amplitude, but the larger internal energy and frequency (thus penetrating ability and multitasking) of perturbations are observed. Figure 6(B) compares it to an apple, wherein red and grey emotions form protective layers, whereas white and yellow provide the essence for which we live. Any cells in the center represent our virtues studied by the positive and transpersonal psychologies, whereas any cells on the borders represent our

imbalances and sins, considered by behavioral and clinical psychologists. The path to the center never ends, as our virtues can evolve infinitely (with ever-increasing “softness” and meaningfulness). But the path to the borders is finite, as increasing the “harsh intensity” is destructive. Yet sometimes “harshness” is also necessary, for protecting our deeper inside (from brutal outer forces), overcoming disproportionate obstacles, or simply learning life lessons (“growing thicker skin”).

Designing the attitudes and predicting the outcomes

As mentioned above, if global vortex is triggered by external factors, it responds by activating its opposite side, leading to either struggle or unification with exterior. For example, if I am exposed to external fear (5-d), in response I may produce either courage (13-a) or anger (13-d), depending on whether I am internally balanced or not. In the first case the external trigger will not affect my “continuum”, but will be gradually transformed to apprehension, carefulness and prudence. In the second case it will cause turbulence, leading to an endless struggle. As considered before, the (speed of an) outcome also depends on perpendicular segments (in this case, 1 and 9) that act as either catalyst or inhibitor. If I am joyful (1b) and thoughtful (9b), then positive transformations will accelerate, but if I am euphoric (1c) or saddened (9c), then negative tendencies will strengthen. In other words, the quality of the arousal-to-interpretation attitude is defined by the closeness of emotions to the center of the wheel.

Recall that in Table 3 fear was opposed by five different emotions: beyond anger it was confidence, contempt, calm, and enchantment. In Figure 6 confidence (16-a) is not opposing fear (5-d) directly, so it can only have an indirect impact, transforming it gradually to disapproval (8-d) and then to insight (8-a, opposite to 16-a). On the other hand, excitement and enchantment can be equated to passion (14-a), an immediate neighbor of courage (13-a) which is a direct opposite

of fear (5-d). So the latter may be transformed in a quicker fashion, first to sincerity (6-b) and then to gratefulness (6-a, opposite to 14-a). Contempt (12-d) is an immediate neighbor of anger (13-d), so it may transform fear to obsession (4-d, opposite to 12-d).

Similar analysis can help to identify typical interpersonal and social conflicts and the ways of their resolution. Sharper colors in Figure 6(A) show that Plutchik's basic emotions form three types of oppositions. Fear and Anger will lead to endless struggle, unless any of them will be replaced with white or yellow cells of the same segment. Disgust and Trust will be in conflict, unless Trust will transform to Admiration, or will be strengthened by perpendicular Surprise and Interest. The last two oppositions, Joy –Sadness and Surprise – Anticipation, showcase a somewhat less fundamental struggle, as “softly intense” Joy and Surprise are stronger than “borderline” Sadness and Anticipation. Yet the outcome depends on perpendicular segments, manipulation of which concludes perhaps the very essence of Aristotle's Rhetoric. A more detailed analysis of how this can be done can be obtained from a more detailed wheel that will be considered below.

Circular Periodicity

Since the Wheel of Emotions forms a closed circular loop, it suggests a possibility of cyclic periodicity. Earlier we noted that there can be many different circular sequences, as nearly any pair of emotions can produce some intermediate state (TenHouten, 1996, Turner 2000, Athar et al, 2011, Cowen et al, 1017, 2019). For example, Joy + Fear = Guilt, although Joy and Fear are not adjacent in the Plutchik's wheel. Yet they become “next to adjacent”, if we place Guilt between them. It resembles mixing colors in an arbitrary order, whereby introducing the unnatural grey tones. This raises question, as to how can we find the „most natural“ circular sequence? Table 5 shows that we should look no further than the original Plutchik's wheel. If we

go around it counterclockwise, its circular sequence correlates with natural feelings during the Sleep – Wake cycle.

Table 5. *Changes of Emotions vs. Sleep – Wake Cycles.*

Hours, Seasons	Mild emotions ^{a)}			(D) Russel (1980)
	(A) Natural	(B) Plutchik's	(C) Adjusted	
Night, Winter	Sleep, stillness, calmness	6. ^{b)} Boredom 5. Pensiveness	11-b. ^{c)} Restrain 9-b. Pensiven.	8. ^{d)} Bored 7. Depressed 6. Frustrated
Morning, Spring	Striving, aspiration, playfulness	4. Distraction 3. Apprehens.	7-b. Surprise 5-b. Carefuln.	5. Angry 4. Tense 3. Excited
Day, Summer	Joy, confidence, curiosity	2. Acceptance 1. Serenity 8. Interest	3-b. Trust 1-b. Joy 15-b. Interest	2. Happy 1. Delighted 12. Content
Evening, Autumn	Flexibility, empathy, release, relax	7. Annoyance 6. Boredom	13-b. Firmness 11-b. Restrain	11. Relaxed 10. Calm 9. Tired

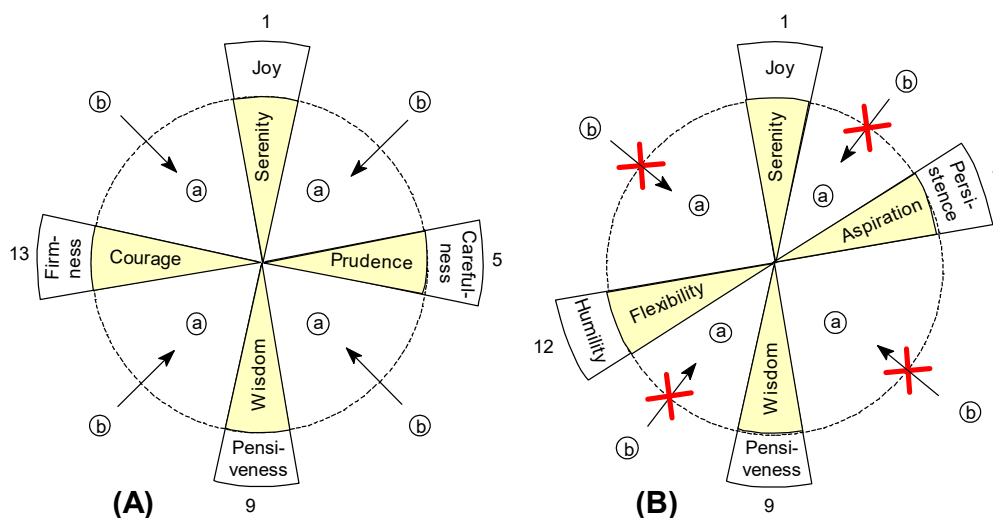
^{a)} Gray background indicates borderline or undesired emotions, white – desired emotions

^{b-d)} Respectively, sequence numbers of petals in the Plutchik's wheel, segments in the adjusted wheel on Figure 4, and emotions in the Russell's circumplex

Column (A) shows that during the night and winter time we are (as most of nature is) much less active than during the day and summer, whereas in the evening and autumn we are more relaxed than in the morning and spring, respectively. This can be related to at least two cycles, circadian (every 24 hours, Dibner et al, 2010) and circannual (every 365 days, Kumar et al, 2018). Circadian rhythms are driven by the internal clock (Vitaterna et al, 2001) which controls our mood in many different ways (McClung, 2013). If broken, it leads to emotional dysregulation, fatigue and sleepiness (Graw et al, 1991; Boivin, 1997; Harvey, 2011). Circannual

cycle also affects our mood, as well as suicides, reproduction, and other measurable factors (Swaab et al, 1996). Since column (A) lists only positive emotions, it may seem somewhat detached from column (B) that deals mostly with borderline emotions (grey background). Yet both of them agree reasonably well with columns (C) and (D), that list positive emotions in an adjusted wheel and core emotions from the Russell's (1980) wheel. This is because all of the considered wheels have arranged their emotions according to the maximum similarity, so Calm is closer to the Sleep, and Joy is closer to Awakeness. Changing this order would make some emotions „dimmer“, as if they were canceling each other out („losing hue“). So the brightness of colors can be compared to the Hundt's arousal. As each color can be of variable brightness, so each emotion can be of variable arousal – quite differently from what the dimensional theory suggests! This effect is further sharpened by the „catalytic“ relationships between orthogonal pairs. For example, Figure 7(A) shows that Joy (1-b) and Pensiveness (9-b) transform to

Figure 7. Perpendicular pairs of oppositions facilitate unification for each other (A), whereas non-perpendicular remain neutral two each other (B)

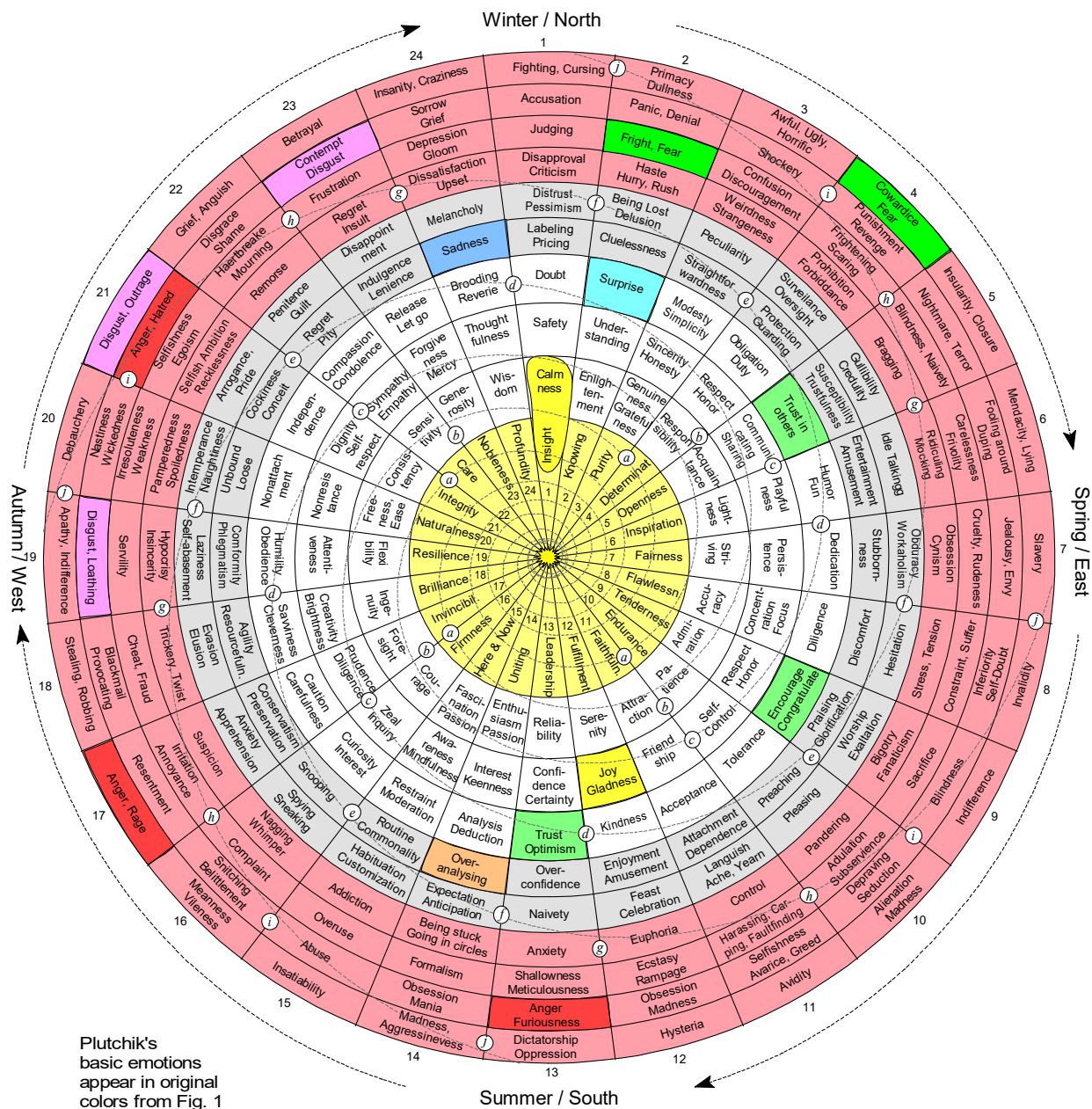


Serenity (1-a) and Wisdom (1-a), as Carefulness (5-b) and Firmness (13-b) transform to Prudence (5-a) and Courage (13-a). This is a „mutually beneficial“ process, as both pairs catalyze each other’s transformation while preserving the „mutual neutrality“ (a „principle of cross“). But if they deviated from orthogonality, their transformations would become much more difficult. Case (B) shows that Joy (1-b) and Pensiveness (9-b) do not enter into a similar relationship with Persistence (4-b) and Humility (12-b). No matter how persistent or humble one will be, he will hardly gain serenity or wisdom. And *vice versa*, no matter how joyful and pensive one will be, he will hardly gain flexibility and aspiration. Thus even slight changes in the circular sequence may have significant impact on the quality of emotions. This is why broken circadian rhythm suppresses the arousal (Thayer, 1989; Schimmack, 1999; Watson et al., 1999), and children perceive reality in sharper colors than adults (Taylor, 2007). Quite simply, children follow the natural order of emotions, whereas adults mix them arbitrarily.

Expanded Wheel and Waving Arousal

Assuming the causal relation in Table 5, we can further improve our wheel by adding more segments and layers in accordance to various natural sleep – wake stages. The larger number of oppositions can potentially increase the homeostatic stability of entire system (Ernest, 2008; Torday, 2015) and make it more interesting – thus more natural (Dyson, 1998). Figure 8 shows an example of such an attempt. The obtained wheel is flipped relative to vertical axis to yield a clockwise movement (according to conventional clock and geographical map).

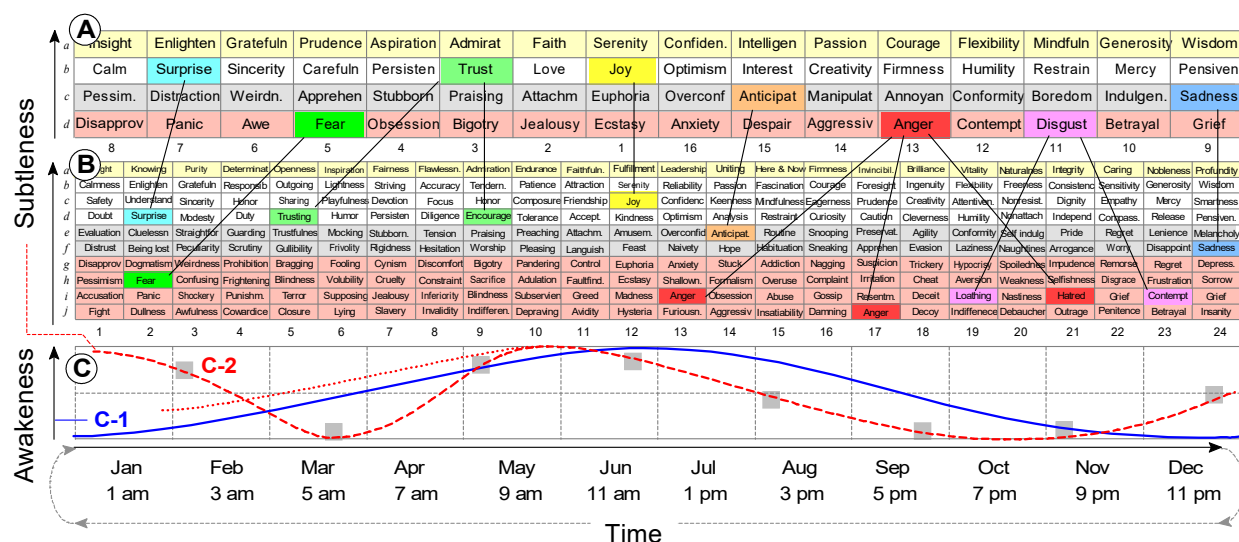
Figure 8. A 24 x 10 Wheel From <http://laimeskelias.lt/atlasas>



A larger number of cells gives a more accurate approximation by their surroundings, a smoother transition in all directions, and a more accurate description of various trigger-and-response scenarios. But on the other hand, it also raises chances of disputable details because of differences in emotion interpretations, languages and experiences. Using analogy of colors,

different types of color mixing (e.g., from emitting light or absorbing paint or ink) yield slightly different orders of their optimal arrangement (hue) (Osborne 2012). There is also phenomenon of metamerism, when a given color is formed by different spectral power distributions, thus suggesting different neighbors for a given state of affect. Figure 9 shows that the obtained wheel duplicates some cells from a smaller wheel (16 x 4), while generally preserving its „pattern of arousal“. The upper vertical axis (Subtlety) measures the distance from the wheel’s edge, denoting cumulatively Desirability and „Soft Intensity“. Horizontal axis (Time) indicates counterclockwise movement in the smaller wheel in Figure 6 and clockwise movement in the

Figure 9. Comparison of wheels: (A) from Figure 4, (B) from Figure 5. (C-1) Natural Sleep – Wake Cycle, (C-2) Artificial Waving Between Balanced and Unbalanced Condition



larger wheel in Figure 8. As we move along the time scale strictly horizontally, we obtain 14 different scenarios of emotional development (4 lines from plot A and 10 from B). Moving along the yellow and white cells reflects positive emotions, not only during the natural (daily, yearly) cycles, but also during any creative work. Moving along grey cells reflects typical urban life that

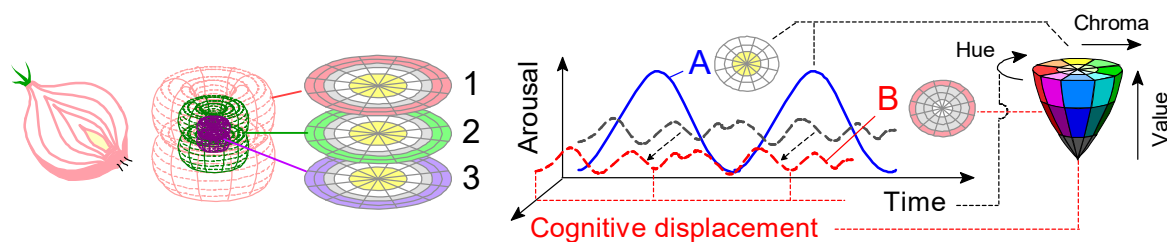
is less balanced, therefore full of „ups and downs“. Finally, moving along red cells reflects negative emotions during struggle cycles, such as menstrual, lunar, unhappy work and/or personal relationship. Note however that strictly horizontal movement is hypothetical. Any creative activity pulls us towards the center of the wheel („centripetal / Coriolis force“), whereas any destructive activity pushes in the opposite direction („centrifugal force“). One may also create loops and shortcuts leading to various maladaptive schemas (Young et al, 2003).

The lower vertical axis (Awakeness) measures an extend to which one feels energized or soporific (Mehrabian, 1980). Blue line (C-1) represents awakeness by the natural sleep – wake cycle, whereas red line (C-2) by the “artificial” disturbances, corresponding to the distribution of Plutchik’s basic emotions in plot A. The first line shows how our activation changes if natural subtleness (desirability, intensity) remains constant. The second line represents “less-natural” subtleness that changes due to our character traits, habits, and socio-cultural conditions. It assumes that Plutchik’s basic emotions are dominant over all other emotions. The dashed red line is „less-natural“ not just because it differs from the blue line, but firstly because it waves between the balanced and unbalanced emotions. Similar oscilations (*e.g.*, between satisfaction and frustration) are common to many cycles of „civilized life“, starting from the smallest learning cycles (Kort et al, 2001), and extending to the largest socio-economic processes (de Groot et al, 2012, Plikynas, 2016). It may indicate something deeply wrong in the way we live as a society, stemming perhaps from such concepts like „reward and punishment“ (described by Sigmund et al, 2001) that are considered deemed necessary in modern culture (Givón, 1989, Liu et al, 2013). This may badly distort the natural flow of emotions, making us feel dim and „half-asleep“

Multiple Cycle Effect

Any repetitive thoughts or actions can be represented by a separate wheel of emotions of arbitrary sequence and size. The interplay among all such wheels will generate the actual pattern of awakesness. Figure 10 shows this as a three-layer onion structure, corresponding to Freud's unconscious, subconscious and conscious, or Barrett's interoception, concepts, and social reality (Barrett, 2017). Alternatively, one may assign them to character traits, habits / convictions, and external factors, many of which were related to emotions and described by circumplex models (Plutchik, 1997a, Plutchik et al, 1997b). If all layers are in resonance, we obtain path A with high awakesness and cognitive ability, similar to what Taylor (2017) calls the "higher-functioning state". But if all layers are in dissonance, we obtain path B which can be related to "intermediate sleepiness". An extreme example are people with abnormally low arousal (attention-deficit hyperactivity disorder, ADHD, and antisocial personality disorder (Lenzi et al, 2018)). This also shifts the entire curve into the 3rd dimension („cognitive displacement“), reducing the

Figure 10. *Onion Model. Arousal Results From Interplay of 3 Levels*



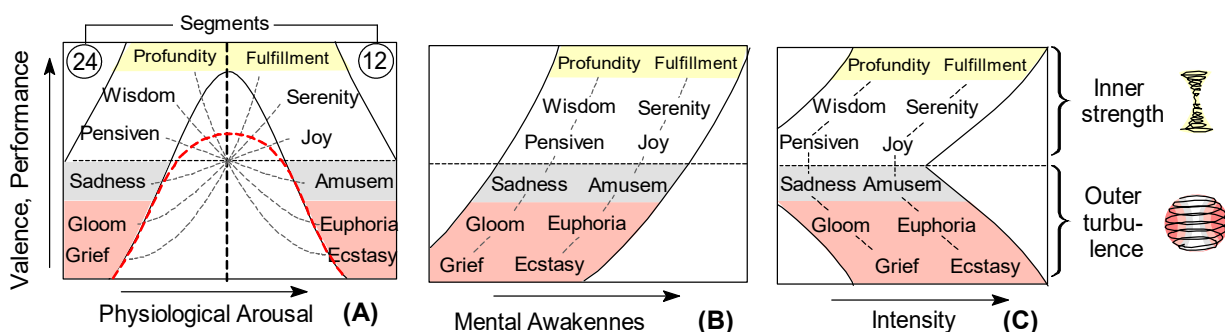
ability to construct positive attitudes and yielding the dimmer perception of reality (Taylor, 2007). Inevitably the arousal pattern should also affect the intensity and subtlety of all emotions,

resulting in just one „cumulative“ wheel with dominating either negative or positive traits. The turning point may be perceived as either mental retardation or awakening.

The Yerkes - Dodson Law

Yerkes and Dodson (1908) found that often arousal has an optimum level, exceeding which causes the performance to decrease. Figure 11(A) shows the resulting bell-shaped dependence using an example of two opposite segments of emotions from the wheel in Figure 8. Vertical axis shows valence, which is related to the internal balancing and intellectual performance, based on assumption that the lasting results are only achieved in a desirable / balanced mood. Dashed red line shows that imbalanced mood will only lead to moderate valence and performance. Plot (B) shows that intellectual performance should steeply increase as we get closer to the center of the wheel, whereas plot (C) relates it to the internal strength and

Figure 11. *Hypothetical Dependences for Opposite Segments*



external turbulence (translating to either excessive suppression or agitation). Plot (A) reminds the Russell's circumplex in Figure 2(A), except that it is „half-circular“, as red emotions from the opposite segments do not close the loop. For example, grief is suppressing, whereas ecstasy is agitating. (This is because our emotions cover just two segments, whereas Russell's model

covers the entire circumplex.) Another difference is that our plot can approach infinite valence, based on the belief that our potential is unlimited. In practice though we always go by the bell-shaped curve, as any given consciousness has its own „roof“. Yet, because the higher (yellow) levels are well balanced, they can permanently hold the physiological arousal at the optimum level. At this point it is consciousness that determines the arousal, rather than *vice versa*. This corresponds to spiritual awakening (as described by Taylor, 2010, 2011, 2017), as well as the top stage of the Maslow hierarchy (self-actualization). Grey and red cells correspond to „normal consciousness“ where the Yerkes – Dodson law applies. White cells hold intermediate position, which may not be stable enough for controlling arousal like in yellow zone. Yellow zone may open unexpectedly, as if onion layers got into resonance, either in the midst of everyday life or during stress and psychological turmoil (Taylor, 2010, 2011). Many people seek it gradually, by willfully putting themselves into critical condition, *e.g.* through fasting (Glaze, 1928), breathing (Edwards, 2005), freezing (Muzik et al, 2018), and running (Roebuck, 2020).

Explaining inexplicable

Above we represented emotions as either internal impulses that elevate us to higher consciousness, or superficial turbulences that excessively suppress or agitate us. Both of these are distinct „quanta“ that arise from indivisible continuum, just like particular colors arise from continuous wavelength scale, or photons and electrons from electromagnetic fields. In a famous [double-slit experiment](#) photons and electrons behave like waves or particles, depending on whether they are counted or not. So are our emotions: they become distinctive, if we pay attention to them, but they dissipate, if we focus on something else. This may also share a new light on our time perception. Since emotions are bipolar, so the time should be bipolar too. In other words, any given moment should be connected to another moment on the “other side” of

the time scale (assuming that it forms an endless wheel, spiral, or vortex). In quantum physics it is known as time reversal or [T-symmetry](#) (Bednorz et al, 2013), [Loschmidt's paradox](#) (Wu, 1975), and [quantum entanglement](#) (Einstein et al, 1935). Such effects mark the edge of our understanding of reality, as for example T-symmetry defies the 2nd law of thermodynamics, whereas particle entanglement implies exchange of information faster than the speed of light. On human scale it relates to phenomena of memory, intuiting, envisioning, and dreaming. Barrett (2017b) proposed: "your brain uses past experience, organized as concepts, to guide your actions and give your sensations meaning". There should also be a backward process however, whereby our perception of the present should affect our perceptions of the past, let alone the future. The ease of such "time travel" should depend on the subtleness of our emotions. Rude emotions lock us in tiny wheels of "struggling oppositions" (and maladaptive schemas), whereas gentle emotions expand the wheel and offer flexibility. Large vortices make time move faster, like water in the center of the whirlpool. So when you are in love, then time goes fast, but when you are in pain, then time flows slowly. It has been noted that children perceive reality at a higher pace and in sharper colors than adults (Taylor, 2007). Earlier researchers attributed this to the volume and complexity of information that adults have to deal with. But we can explain it by the smaller emotion vortices of adults, due to both unnatural sequence of emotions and „ruder“ (more categorical) judgements that lock them into struggle. Finally, each emotion can be viewed as an independent time scale, stemming from its resemblance to an independent mini-vortex. A pair of united opposites should then represent a complex plane of time (composed of many alternative scenarios from which we can choose the most desired ones). Two perpendicular pairs of opposites should yield quaternionic space of time (a higher state of consciousness corresponding to yellow cells). Applying [Hurwitz theorem](#) (composition algebras), symmetry rules in

[hypersphere packing](#), and [Automata theory](#), one may hypothesize about much wider breadth of self-organizing systems.

Conclusions

The vortex of emotions helps us to look at various phenomena from a new perspective, that encourages us to seek a higher consciousness. From analytical perspective, it explains dependences between various emotion scales and their relations to sleep – wake cycle and intellectual performance. From philosophical perspective, it answers the major existential question, why do we exist, and conceptually relates emotions to morality, color theory, fluid mechanics, quantum physics, algebra, and other fields where the principle of the Unity of Opposites is operative. It states that every phenomena has two sides: superficial „formality“ that causes struggle, and indepth „heart“ that unities all concepts. On a motivational side, it shifts the focus from „just recording and interpreting“ emotions to generating new emotions of both higher gentleness and higher internal strength. As Descartes (1649/ 1985) said, “everyone has experience of the passions within himself, and there is no necessity to borrow one’s observations from elsewhere in order to discover their nature.” Yet there is a need to make our passions more meaningful. The vortex model aligns pleasantness with ever-increasing meaningfulness – a step that distinguishes immature youngsters from wise elders. Essentially it teaches us how to “mix business with pleasure”, by designing stronger attitudes and living naturally, according to maximally wide and balanced sequences of emotions. A combination of well-thought radial scales with natural circular sequence(s) can make it very useful for optimizing emotion patterns during everyday life, learning cycles, interpersonal and socioeconomic development. Yet, the proposed wheels may need further adaptation to various socio-cultural situations.

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