



How poetry evokes emotions

Philip N. Johnson-Laird^{a,b,*}, Keith Oatley^c

^a Department of Psychology, Princeton University, Princeton, NJ 08544, USA

^b Department of Psychology, New York University, 6 Washington Place, New York, NY 10003, USA

^c Department of Applied Psychology and Human Development, University of Toronto, 252 Bloor Street West, Toronto M5R 1V6, Canada

ARTICLE INFO

Keywords:

Aesthetics
Emotions
Mental models
Poetry
Prosody
Simulations

ABSTRACT

Poetry evokes emotions. It does so, according to the theory we present, from three sorts of simulation. They each can prompt emotions, which are communications both within the brain and among people. First, models of a poem's semantic contents can evoke emotions as do models that occur in depictions of all kinds, from novels to perceptions. Second, mimetic simulations of prosodic cues, such as meter, rhythm, and rhyme, yield particular emotional states. Third, people's simulations of themselves enable them to know that they are engaged with a poem, and an aesthetic emotion can occur as a result. The three simulations predict certain sorts of emotion, e.g., prosodic cues can evoke basic emotions of happiness, sadness, anger, and anxiety. Empirical evidence corroborates the theory, which we relate to other accounts of poetic emotions.

1. Introduction

For as long as people have studied poetry, they have recognized that it evokes emotions. One of Plato's concerns, for example, was that it fosters emotions that ought to be restrained (*Republic*, 10.606 (Plato, 1961)). Yet, psychologists have investigated poetry less often than other arts (Hanauer, 2001). They have studied it to elucidate memory, phonological development, and reading, more often than for its own sake. It stands between narrative arts and music: it can have semantic contents as do stories and plays, but, as Plato (*Gorgias*, 502c) also recognized, it has rhythms and meters—prosody—as does music. Some poems are novels, such as Pushkin's *Eugene Onegin*. Some poems have abandoned words for sounds alone, such as the *Ursonate* of Kurt Schwitters. Like narratives and music, if a poem does not move its audience, it fails. Psychologists have offered accounts of some of its emotional effects. What they have not proposed, however, is an explanation that relates poetry's emotional impact to current theories of emotion and of mental representation. Our aim is to present such a theory. It addresses the fundamental question of how poetry evokes particular emotions. It was developed from our earlier accounts of music and emotions, and visual art and emotions (Johnson-Laird & Oatley, 2016, 2021). And like these accounts, it is rooted in our communicative theory of emotions (e.g., Oatley & Johnson-Laird, 1987, 2014) and the mental model theory of discourse and reasoning (e.g., Byrne, 2005; Johnson-Laird, 1983; Ragni & Johnson-Laird, 2021). When we had

developed the present theory, we searched for relevant empirical studies of poetry. Its almost universal corroboration was surprising. But, there remain various predictions of the theory that have yet to be tested.

Poetry was once only spoken; non-literate cultures still recite it (see, e.g., Bloomfield, 1986). History proper began with writing, and the writing of poems. But, literature varies. At one extreme, readers can see through writing to the scenes it depicts. As George Orwell, 1970, p. 30 remarked, "Good prose is like a window pane." When individuals read in this Orwellian way, they experience the world as if perceiving real events. At the other extreme, however, writing is not so transparent. Its surface attracts the reader's attention. James Joyce, who began his literary career as a poet, commented: "The important thing is not what we write, but how we write" (Power, 1974). When individuals read in a Joycean way, they notice the words, and how the author has arranged them. The two ways of writing lie at the root of the difference between prose and poetry. Prose that is transparent enables individuals to envisage the events that it depicts, which can then evoke emotions as they would in reality (see, e.g., Hogan, 2018; Oatley, 2011, 2016). Poems that are more opaque depend on many sorts of surface cue, which, as Jakobson (1960) argued, may make them harder to understand. Yet, these arrangements of surface cues can have an emotional impact, too.

Our theory postulates that poetry can elicit simulations of three sorts, which each can evoke emotions. The first sort of simulation occurs as part of understanding natural language. It yields a mental model of a

* Corresponding author at: Department of Psychology, Princeton University, Princeton, NJ 08544, USA.

E-mail addresses: phil@princeton.edu (P.N. Johnson-Laird), keith.oatley@utoronto.ca (K. Oatley).

<https://doi.org/10.1016/j.actpsy.2022.103506>

Received 27 July 2020; Received in revised form 10 January 2022; Accepted 14 January 2022

Available online 29 January 2022

0001-6918/© 2022 The Authors.

Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

situation—a view through the window pane—and events there can evoke emotions from prose or poetry. The comprehension of poetry can be challenging because it uses figures of speech, or “tropes,” which call for special processes of interpretation. The second sort of simulation is almost unique to poetry. Its *prosody* elicits a simulation in which meter, rhythm, and rhyme, evoke emotions by mimicking the characteristics of people in emotional states—music and abstract art use a similar method (Johnson-Laird & Oatley, 2016, 2021). Prosodic cues can amplify the emotion that the poem’s contents prompt, or they can conflict. A dirge written in jolly rhymes and alliterations creates mixed feelings. It may fail as a work of art. The third sort of simulation relies on your access to a model of yourself. It enables you to realize that you are engaged with a poem: you are aware that you are enjoying it, or not, as may happen with a jolly dirge. And it also enables you to evaluate it, and sometimes to experience an aesthetic emotion. Simulations are not the only processes that evoke emotions from poetry. If you witnessed Allen Ginsberg reciting his poem, *Howl*, you may have associated emotions from this experience to the poem, just as ceremonial music can elicit your extramusical but associated emotions (Johnson-Laird & Oatley, 2021). Likewise, critics and listeners project semantic content onto music, which can elicit emotions of its own. One critic, for instance, referred to the start of the recapitulation in the first movement of Beethoven’s *Ninth Symphony*, as expressing “the throttling murderous rage of a rapist”. Other critics projected other interpretations (see the analysis in Johnson-Laird & Oatley, 2016). A similar projection from emotions evoked outside a poem may occur on reading it. If you know that Keats’s (1816–20) sonnet, *Bright Star* reflects his unconsummated passion for Fanny Brawne, your projection of this knowledge onto the poem may evoke emotions that would not occur otherwise. We say no more about emotions that result from associations or projections, because these mechanisms are not unique to poetry.

This simulation theory is—to use Marr’s (1982) terms—at the *computational* level: it concerns what the brain computes. It has implications for the *algorithmic* level, which explains how such processes are carried out. But, because no algorithmic theory yet exists, its implications for the *wetware* level (neuroscience) are restricted to localizing various processes in particular regions in the brain (e.g., Jacobs, 2015).

The article begins with the precursors to the theory: the nature of poetry, the communicative theory of emotions, and the theory of mental models as simulations. It describes the three sorts of simulation: of contents, of prosody, and of the self. Prosody is a focus, because of its particular relation to poetry, and its simulation yields novel predictions about basic emotions. Finally, the article relates the simulation theory to other accounts of poetry and emotion.

2. Precursors to the theory

2.1. The nature of poetry

Poetry has no neat definition—no general truth that applies to all and only poems. As we have already mentioned, not all poems are even in a natural language. Poems do, however, have several typical characteristics. One is metaphor (Holyoak, 2019, p. 2). A metaphor such as Auden’s:

He was my North, my South, my East and West

is more powerful than a simile, which only likens one thing to another. In its literal interpretation, the metaphor is false, but it establishes a new concept of which its subject is an instance—he was a person who bounded another’s life. Likewise, Shakespeare’s metaphor from Sonnet 18:

But thy eternal summer shall not fade

invokes the concept of a desirable aspect—beauty, in this case—that endures despite time (for contrasting views that nevertheless share this

idea of metaphor, see, Glucksberg, 2001; Lakoff & Turner, 1989). Metaphors are not special to poetry, and not all poems are centered on them, and some contain none, e.g., Sparrow’s poem below. But, many – perhaps most – do, and poems are a major source of novel metaphors that enter the language, e.g., “climate of opinion” which Auden wrote in his poem in memory of Freud; the phrase peaked later (see Google ngram). Other tropes are abundant in poetry, but again no-one knows whether they evoke emotions in ways that would not occur outside poems.

Another characteristic of poetry is brevity. Most lyric poems are short and contain fewer words than stories do. Lydia Davis (2010) and other recent authors have written stories as short as the briefest verse: they could be poems, because the genre has no precise border. But, even the longest epic poems are shorter than some novels: Proust’s (1913–1927) *À la recherche du temps perdu* (*In search of lost time*) is longer than Pushkin’s (2008) *Eugene Onegin* by an order of magnitude. So, why are so many poems brief? One of their aims appears to be to compress the expression of emotions into as succinct a form as possible. They can, as we will see, express a complex emotion in a way that seems beyond narrative prose. Part of their capacity to do so is prosody.

Two characteristic aspects of the prosody of many poems are meter and rhyme. Consider this clerihew (Bentley, 2014), a form of light verse that mocks the famous:

Sir Christopher Wren
Said, “I am going to dine with some men”.
“If anybody calls”
“Say I am designing St. Paul’s.”

It is doggerel, but it has rhymes. Remove them, and the wit disappears along with the poem itself:

Sir Christopher Wren
Said, “I am going to dine with some colleagues.
If anybody wants me,
Say I am designing St. Paul’s”.

Another characteristic of poetic prosody is the existence of traditional forms. Some forms depend on the repetition of words (the sestina) or of complete lines (the villanelle). Repetition is also a primary component of musical form in symphonies, sonatas, and other sorts of composition. Why should a poem in the form of a villanelle, such as Dylan Thomas’s *Do not go gentle into that good night* contain repetitions of that line, or Elizabeth Bishop’s *One Art* repeat the line: “The art of losing isn’t hard to master”? If a speaker keeps telling you the same thing, you infer that it is important. It may not communicate a particular emotion, but it arouses your attention and the repeated line may lodge itself in your memory. That, perhaps, is why the villanelle has lasted over five hundred years.

A common characteristic of poems is their purpose. The majority of them seek neither to instruct nor to persuade but instead to induce reflection (cf. Schank & Berman, 2002). But some do offer directives, such as Virgil’s *Georgics*, Pope’s admonitions to aspiring poets (see below), and from over a century ago Kipling’s advice to *The young British soldier*, which has acquired an ironic pertinence:

When you’re wounded and left on Afghanistan’s plains,
And the women come out to cut up what remains,
Jest roll to your rifle and blow out your brains
An’ go to your Gawd like a soldier.

Most poems, however, exist only for us to enjoy and to reflect on. And empirical evidence supports this role for literary art (Djikic et al., 2012; Djikic & Oatley, 2014). In his poem *In memory of W. B. Yeats*, Auden (1977) perhaps overstates the case: “Poetry makes nothing happen,” because Yeats himself in a late poem, *Man and the echo*, mused:

Did that play of mine send out certain men the English shot?

Table 1

Basic Emotions: the cognitive evaluations and consequences for those that are free-floating, and the objects and consequences in plans and actions for those with known objects.

Basic emotions: free-floating	Cognitive evaluations in relation to goals	Cognitive consequences in actions
Happiness	Success	Continue
Sadness	Loss, separation, failure	Do nothing
Anger	Obstruction	Aggress
Anxiety	Threat	Find safety
Basic emotions: with known objects	Individual objects	Cognitive consequences in plans and actions
Love	Partner, offspring, person, or entity	Courtship, nurture, care
Hate	Person or entity	Neglect, harm
Boredom	Person, entity, situation	Leave, ignore, seek change
Disgust	Noxious person or entity	Reject, expel

Poems can be at the extremes of Orwellian or Joycean writing. There are poems of ideas and poems of sounds. A poem that expresses just an idea is Sparrow's (2005) last word:

This poem replaces all my previous poems.

It could be a work of conceptual art akin to one of Robert Barry's images. And, like works of the Language School of poets, such as Charles Bernstein, it blurs the distinction between prose and poetry. In contrast, as Valéry (1977, p. 147) recounts, when the painter Degas told Mallarmé that he was full of ideas for poems, the latter replied, "one does not make poetry with ideas, but with words". Indeed, the words in Mallarmé's Symbolist poems can be hard to construe, such as his *L'Après-midi d'un Faune* (The Afternoon of a Faun). Its opening lines are:

Ces nymphes, je les veux perpétuer.
Si clair,
Leur incarnat léger, qu'il voltige dans l'air
Assoupi de sommeils touffus.
(These nymphs, I would perpetuate them.
So bright
Their crimson flesh that hovers there, light
In the air drowsy with dense slumbers.)

It is the sonorous syllables and their vague dream-like images that move us—just as Debussy's eponymous composition does.

Words matter. One word can be substituted for another in a poem *salva veritate*, but not with impunity. The opening couplet of verse XXV of Keats's *The Eve of St. Agnes* is:

Full on this casement shone the wintry moon,
And threw warm gules on Madeline's fair breast.

We can translate these lines into modern English:

The winter moon shone fully on this window,
and cast a rosy glow on Madeline's beautiful chest.

The original's archaic language has a romantic aura; the modern version is bathetic.

In summary, poems vary in the relative importance of their ideas and words. Typical poems embody metaphors, they are succinct, they have meter, rhythm and rhyme, and they have no extra-literary goals. And all these features seem to help them to evoke emotions.

2.2. The communicative theory of emotions

Cognitive accounts of emotions fall into two main families. One family goes back to Kant, 1951 and treats emotions as based on

dimensions such as degree of arousal and of pleasure-displeasure (Russell, 2003). The other family goes back to Darwin, 1965 and treats each basic emotion as having a distinct function, expression and behavior, and evolutionary advantage (cf. Menninghaus, 2019; Simon, 1967). The communicative theory is in this Darwinian family. It postulates that emotions are signals that differ in their aims (Oatley & Johnson-Laird, 1987, 2014). These signals occur among members of the same species, but they also have corresponding signals in the brain to prepare individuals for a relevant course of action or inaction (see also Frijda, 2007). Emotions are thus a meeting place for subjective feelings, somatic responses, and bodily actions. And they vary in degree. In humans, they are founded on the same basic emotions that occur in other social mammals: happiness, sadness, anger, and anxiety. You can experience them without knowing their specific cause; they can be free-floating and the bases of moods. But you can also experience them with complete awareness of their cause or object. Indeed, certain basic emotions such as love, hate, and disgust, cannot be experienced except in relation to known objects. Table 1 summarizes the basic emotions, both those that can be free-floating but may not be, and those that must have known objects: it presents the typical cognitive evaluations evoking them, and the typical actions and plans they inspire.

One striking corroboration of basic emotions occurs in psychological illnesses. Most individuals who suffer from them can recall their onset, and the particular emotion that they experienced (Johnson-Laird et al., 2006). It is almost always a basic emotion; and the only exception is that a few patients report feeling guilt. Another corroboration occurs with music. Associations and projections aside, pure music evokes only free-floating basic emotions, or mixtures of them (Johnson-Laird & Oatley, 2008).

Humans have complex emotions, too. Their emotional foundation is a basic emotion, but one that is integrated with semantic content (Oatley & Johnson-Laird, 1987)—a conjecture of the original communicative theory that more recent fMRI studies corroborate (Pessoa & Pereira, 2013). Complex emotions are commonplace in daily life, and fictional works can evoke them too. Typical examples are pride—a happiness in oneself; sympathy—sorrow in another's situation; and jealousy—anger or anxiety at an interloper in a sexual or social relationship.

2.3. Models as simulations

Craik (1943) proposed that the mind constructs small-scale models of the world, where a model has the same input and output as what it represents. So, Kelvin's tidal predictor is a model of the tides, though its system of pulleys is remote in structure from the sea, moon, and earth. Mental models of events can be run faster than those in real time in order to assess the outcomes of putative decisions, and in this way can lead to prudent choices. The present simulation theory adopts the same idea, but with two significant changes. First, its models are iconic insofar as possible, that is, unlike the tidal predictor, their structure corresponds to the structure of what they represent. Second, contrary to Craik's claim that human reasoning depends on verbal rules (ibid., p. 78), the simulation theory pushes his account one step further: the comprehension of discourse yields models on which reasoning itself is based (Johnson-Laird, 1983).

If readers are unfamiliar with the more recent model theory, we can illustrate it with a simple example. Imagine a toy railway track that runs from left to right, and that has a single siding in the middle, which is entered from the left, and exited to the left. A train with four cars stands in this order, ABCD, at the left-hand end of the track. Now, try to envisage the consequences of the following actions on this train:

Move all the cars onto the siding.


As long as there is at least one car on the siding, move one car off the siding to the left track and then over to the right track.

What is the resulting order of the cars on the right track? Adults and


children who know nothing of programming can carry out this task and other more complicated re-orderings too (Khemlani et al., 2013). The correct answer is that the cars on the right track are now in the reverse order: DCBA. If you disagree with the answer, here is a sequence of diagrams—akin to those in a computer program that implements the theory, and that devises its own programs to solve re-orderings (see mAbducer at modeltheory.org). The diagrams illustrate the iconic nature of a kinematic mental model. The starting situation is:

Start: ABCD


As you understand each move, you can carry it out on your mental model of the railway:

Move 1: ABCD


Move 2: A


Move 3: BCD


Moves 2 and 3 are repeated in a loop until all the cars have left the siding, which is now empty:

End: DCBA


Loops of this sort can compute the values of any recursive function, and so they are the basis of computation (Johnson-Laird et al., 2021). Individuals envisage their consequences in the same temporal order as actual moves of the cars, and so they are building a kinematic model of the sequence of moves. This account contrasts with the idea that reasoning depends on extracting the logical structures of sentences and applying formal rules of inference to them (e.g., Rips, 1994)—an idea that dominated the psychology of reasoning for much of the twentieth century.

The example illustrates how mental models can be the output of comprehension and the basis for deductive reasoning. To establish these claims, however, called for many experiments. One corroboration of iconicity is mental rotation: individuals envisage rotating three-dimensional objects just as readily in depth as in the plane of the picture depicting them (Metzler & Shepard, 1982). Another corroboration of iconicity is that when ten-year old children carry out rearrangements of trains, they make many gestures analogous to actual moves of the cars. Gestures are outward aids for inward kinematics, because when children are prevented from gesturing, their performance suffers in a reliable way (Bucciarelli et al., 2016). Experimental research has made a similar case for iconic models as a result of understanding discourse (e.g., Johnson-Laird, 1983), and as a platform for reasoning of all sorts—deductions (Byrne & Johnson-Laird, 2019), inferences about possibilities (Ragni & Johnson-Laird, 2021) and probabilities (Khemlani et al., 2015), and abductions (Johnson-Laird et al., 2021). Not everything, however, can have an iconic representation. Negation, permissibility, and truth, need symbolic representations that access their meanings.

Students of discourse have proposed many variants of ‘situation’ models, not all of which are iconic (e.g., Glenberg & Kaschak, 2002; Kintsch & van Dijk, 1983; Zwaan, 2016; Zwaan & Radvansky, 1998). These accounts allow for embodied cognition and sensory-motor simulations. But, these theories and the iconic theory of mental models have been quite isolated from one another. For instance, a recent paper claimed: ‘Most studies on mental simulations have used the sentence-picture verification tasks to examine whether single object properties are simulated during language comprehension’ (Hoeben Mannaert et al., 2020). Yet, iconicity and kinematics are crucial. They enable

models to underlie visual, auditory, and other images. And they yield inferences as emergent consequences of premises, which otherwise would be intractable logical deductions (Johnson-Laird, 1983, p. 250 et seq.). Hence, a need exists for a rapprochement between situation models and mental models (see also Garnham, 2021).

When a poem is written in a natural language, its comprehension depends on a compositional semantics: the meanings of clauses and sentences are composed from the meanings of their constituents using the syntactic relations among them as a recipe—all the way down to the meanings of atomic morphemes. Special processes are needed to interpret novel metaphors and other tropes. The resulting meaning in an intensional representation is used to construct a mental model of the situation or to update an existing model. The process has been implemented in computer programs for various aspects of natural language and reasoning (available at <https://www.modeltheory.org>).

The opening lines of T. S. Eliot’s *The love song of J. Alfred Prufrock* can elicit a visual image:

Let us go then, you and I,
 When the evening is spread out against the sky
 Like a patient etherized upon a table

The clauses elicit a representation of their meaning. The trope in the second line makes no sense in a literal interpretation, but implies that the signs of evening such as the clouds around a setting sun are spread out across the sky. It is this spread to which the simile in the third line refers. The resulting intension yields a model that can be realized in a visual image. We now turn to the first kind of mental simulation in poetry that evokes emotions.

3. The first simulation: contents

When people read a story, they construct a kinematic model of the scenes and events that it depicts. Characters are central (Garnham, 2021), and novels and other narratives can evoke emotions, much as if readers were experiencing the events for themselves (see, e.g., Oatley, 1994, 2004, 2011). So, readers experience basic and complex emotions, and can have sympathy for characters and empathize with them (Cupchik et al., 1998). Models of the contents of many poems evoke basic emotions. Gerard Manley Hopkins in *Pied Beauty* evokes joy in the dappled nature of the world—a poem likely to elicit visual imagery from a model of its contents. Shakespeare’s *There is a willow grows aslant a brook* evokes sadness for the tragic death of Ophelia in *Hamlet*. The auditory and visual imagery of the drumming soldiers in Auden’s *O what is that sound which so thrills the ear* starts by evoking apprehension, but the emotion slowly builds into empathic terror as readers realize that the marching army is coming for the narrator’s spouse. Likewise, it is difficult not to read Adrian Mitchell’s excoriation of a British politician (*Lord Home The Foreign Secretary*) without stirrings of anger, and D. H. Lawrence’s disdain in *How beastly the bourgeois* is spills over into disgust: “like a fungus, living on the remains of bygone life”.

The contents of poetry can create complex emotions too. In Yeats’s *Easter 1916*, the poet confronts his own feelings about the Irish nationalists whose attempted revolt the British crushed without mercy. Yeats disliked violence. He had thought little of the leaders of the rebellion and despised at least one of them. But, their peremptory execution by firing squad was an enormous shock, and, as he wrote:

All changed, changed utterly:
 A terrible beauty is born.

If Yeats (1999) in his *Autobiographies* had described this transformation in his feelings, he could hardly have evoked so powerful an emotion in so few words. The poem succeeds, because it binds together his early reactions towards the leaders, his feelings for Ireland, and the sacrifice that changed everything—Ireland became the first country to exit the British Empire.

Some contents evoke emotions at one remove. T. S. Eliot (1921) wrote:

The only way of expressing emotion in the form of art is by finding an ‘objective correlative’; in other words, a set of objects, a situation, a chain of events which shall be the formula of that particular emotion; such that when the external facts, which must terminate in sensory experience, are given, the emotion is immediately evoked.

Eliot’s example is of how Shakespeare conveys Lady Macbeth’s state of mind as she sleepwalks. In her obsessive attempts to clean her hands of the blood she imagines to be on them, she reveals her guilt in murder—a guilt that leads to growing insanity. Her state of mind is not described, but rather the audience infers it from her words and actions as she sleepwalks. The use of an objective correlative, however, is common to all narrative arts. And it is just one way to communicate what an individual is feeling.

In lyric poems, as their musical origin suggests—songs sung to the accompaniment of a lyre—poets often tell us what they are feeling. An example is this fragment from Sappho, circa 550 BCE/1993, p. 78). The first three lines are Sappho’s words to the Greek goddess of love, Aphrodite, about her latest lover’s rejection, and the lines that follow are the goddess’s reply:

... you [Aphrodite] ... asked me what had gone wrong this time
why was I begging,
and what in my demented heart, I wanted most
“Who shall I persuade this time
to take you back, yet once again, to her love;
who wrongs you Sappho?
For if she runs away, soon she shall run after,
if she shuns gifts, she shall give,
if she does not love you, soon she shall even
against her own will.”

The poet expresses her emotion, and sends herself up a little in the goddess’s sardonic reply.

Neither prose nor poetry can easily create certain complex emotions. Readers can empathize, say, with Marcel’s jealousy for Albertine when she goes out without him (in Proust’s *À la recherche du temps perdu*), but they probably don’t feel jealous of her themselves. They might feel embarrassed on behalf of the poet, on reading William McGonagall’s laughable *The Tay Bridge Disaster*, but hardly embarrassed in themselves. Jealousy and embarrassment depend on your relations to others, as simulated in a model of yourself. They are self-conscious emotions. Prose or poetry often elicits memories of events that you have experienced and the emotions that they aroused (see Oatley, 2011), but, while reading, you may not always feel the self-conscious emotions of a character or author. Yet, as we argue later, aesthetic emotions do depend on self-awareness.

One final point about models of content is that a lyric poem, if it is to succeed, must be open to an intuitive understanding: its mental model should suffice to evoke emotion. But, other genres call for a closer reading. When readers first encounter a poem such as *Easter 1916*, they may find it hard to understand. What helps, of course, is familiarity with the pertinent historical events. Poetry can exploit difficulty (Eliot, 1932), deliberate ambiguity (Empson, 2004), and literary tropes (Oatley, 2002). Individuals may need to re-read, to go beyond their intuitive understanding to deliberate on the basis of fully explicit models embodying their knowledge, and to explore alternative interpretations. An experimental study has confirmed that the *contents* of poems without their accompanying prosody can excite emotions (Menninghaus et al., 2017). And, as the next section shows, the simulation theory predicts that prosody has its own ways to evoke emotions.

4. The second simulation: prosody

In the normal comprehension of language, people soon forget the words and syntax of sentences (e.g., Johnson-Laird & Stevenson, 1970). They are Orwellian in their understanding and retain just a model of the situation (e.g., Garnham, 1987). With sensible poetry, as with all literary art, they also simulate situations. But the simulation theory predicts that in a poem the choice of words, their arrangement, and the phonological cues in its prosody, can also focus attention on the surface of sentences, and turn readers into Joycean readers. The text itself becomes memorable: Auden remarked that poetry is ‘memorable speech’ (Auden & Garrett, 1935). A poem can therefore arrest the normal rapid decline in memory for surface detail (Tillmann & Dowling, 2007). And the focus on words and prosody leads readers to simulate the emotions and state of mind that the poem is constructed to convey—sometimes the poet’s, sometimes a character’s, sometimes the reader’s. The simulation of prosody is akin to simulating, not the scene in a painting, but its style, form, and brushstrokes, to yield a model of the emotions lying behind their creation (Freedberg & Gallese, 2007; Johnson-Laird & Oatley, 2021). In the last century, prosody was shown to evoke emotions (Hevner, 1937). In the present century, this finding has been corroborated (see Kraxenberger et al., 2018). We examine these findings, cue by cue.

Prosody refers to three principal features of poetry: meter, rhythm, and rhyme. The simulation theory treats them all as cues to evoke particular basic emotions. They have analogs in music (Menninghaus et al., 2018)—to the point that some theorists argue for communalities in brain localization and function (e.g., Lerdahl, 2001). These prosodic cues are also exploited in care-givers’ talk to infants, in prayers, and in other social rituals. Until late in the nineteenth century, they were ubiquitous in European poetry, and then free verse supplanted them, though poets still use prosody. To understand its cues, we need to make a detour into music and speech.

4.1. Meter and rhythm in music and speech

Musical meter transforms regular pulses at equal intervals of time into a loop of groups of a small number of them, which are known as “measures” or “bars”. Most music is metrical, e.g., a polka has two beats to the measure, a waltz has three, and a march has four. The rhythm of a melody is the sequence of onsets of its notes, some coincide with the beat, but others do not: they occur between beats. In some metrical genres, a musical event in the accompaniment to a melody occurs on every beat, e.g., most jazz and rock, but in others, it does not, and listeners tacitly infer meter from the rhythm of a piece. Meter establishes a hierarchy of subdivisions, i.e., a single beat can in turn be divided into two or three, and so on, over several levels (Longuet-Higgins, 1987). So, a waltz tends to divide each of its three beats to the measure into two (count: 1 2, 2 2, 3 2), whereas the same six pulses can occur in two beats divided into three (count: 1 2 3, 2 2 3). Leonard Bernstein’s *I like it here in America* from ‘West Side Story’ has adjacent measures contrasting these two meters. Composers and improvisers can use meter to vary the predictability of the notes in rhythms and to use syncopations, which are notes that occur before a beat and last through its onset, and similar notes on smaller metrical subdivisions (Longuet-Higgins, 1987).

The perception of rhythm can depend on meter, and the perception of meter can depend on rhythm. Rhythm is accordingly a sequence of events, of which their respective onsets are critical. They are what make a children’s game viable: one child claps the rhythm of a well-known tune (clapping yields only a sequence of onsets), which the other children have to identify. But, rhythms come in families based on prototypes, which reflect how each onset relates to a metrical division. This hypothesis was borne out in participants’ judgments of the similarity of rhythms (Cao et al., 2014).

Speech consists of vowels and consonants, and a few rare exotica such as vocal clicks. The larynx vibrates and creates a fundamental

pitch—the vibration with the lowest frequency—and a plethora of harmonic overtones, each of a progressively higher pitch but lower loudness, where perceived pitch corresponds roughly to the frequency of the fundamental. Vowels are made up of bundles of adjacent harmonics (integral multiples of the fundamental's frequency), which resonances in the vocal tract amplify. These bundles (or “formants”) occur at different pitches, and the lowest two formants usually suffice to distinguish different vowels. The English vowels in these words: “heed”, “hid”, “head”, and “had”, have a lowest formant that descends from a relatively high pitch, whereas the vowels in these words “hod”, “hoard”, “hood”, and “who'd”, have a lowest formant that is already low in pitch and that descends towards the fundamental pitch. If you say, “who'd heed”, you'll notice the rise in pitch.

Consonants result from interruptions to the flow of air. The interruptions can be partial, as in “ss” and “sh” sounds, or complete when the lips close and then open with an explosive release of air, as in “b” and “p”. The difference between the latter pair is that the larynx starts to vibrate sooner after the blockage for “b” than for “p”. Indeed, a major discovery in phonetics is that the cues to different speech sounds are not distinct like letters in a written word, but overlap in time like strata (see, e.g., Clark et al., 2007).

Speakers and listeners are unconsciously sensitive to many aspects of the articulations of speech sounds. In English, words have stable patterns in stress. Speakers say: **dinner**, not dinner, where bold font denotes stress on a syllable. Stress makes for ease of comprehension (Cutler & Foss, 1977), and its pattern helps to identify words (e.g., Rothermich et al., 2012). Naive individuals suppose that stress depends on speaking louder. In fact, it is much more dependent on raising the pitch of the fundamental of the syllable's vowel. Speakers raise this pitch to stress a syllable, or to emphasize a word, as in: “**Who** do you think you are?” To express a great surprise, the fundamental in English can rise by four times its frequency in the preceding syllable—the equivalent of two octaves in music.

4.2. Meter and rhythm in poetry

In English and other languages such as Dutch and German, stresses tend to come at regular intervals in spontaneous speech. When people have to tap in time to speech, they tend to tap at the onset of the vowel in a stressed syllable (Allen, 1975). But, in other languages, such as French and Italian, syllables rather than stresses tend to come at regular intervals, or at least to be perceived to do so. In “stressed-timed” languages such as English, poetry favors meters in which each line has a given number of stresses. For instance, the iambic pentameter is a meter of five stresses to the line, as in the opening quatrain of Thomas Gray's *Elegy written in a country churchyard*:

The **curfew tolls the knell** of parting day,
The **lowing herd** wind **slowly o'er** the lea,
The **plowman homeward plods** his weary way,
And **leaves the world to darkness and to me.**

Every line is made up of five *feet*, each of which has an unstressed syllable followed by a stressed one: **dada** (the iambic foot). The opposite pattern: **dada** (the trochaic foot) yields a different meter, salient in Longfellow's *The song of Hiawatha*:

By the shores of Gitche Gumee,
By the shining Big-Sea-Water,
Stood the wigwam of Nokomis,
Daughter of the Moon, Nokomis.

Other meters are based on feet of three syllables, such as: **dadada** (anapestic foot) and **dadada** (dactylic foot). Every possible pattern of stress is categorized as a foot in poetics, up to those of four syllables. When listeners hear sounds that alternate in stress and non-stress, they group them into trochaic feet, **dada dada**. But, when they hear sounds

that alternate long and short durations, they group them into iambic feet, - — - — (Hay & Diehl, 2007). These perceptual groups occur for speech and for non-speech, and may depend on an interaction between innate and cultural factors (Crowhurst, 2020).

In “syllable-timed” languages, poetry favors a syllabic organization: each line has a given number of syllables, e.g., the Alexandrine in French is a line of 12 syllables as in:

Qui pleure là, sinon le vent simple, à cette heure
(What weeps there, if not simply the wind, at this hour)

which is the first line of *La Jeune Parque* (*The Young Fate*), a poem of 9^o Alexandrines by Valéry (1977). However, poets have written syllabic verse in English at least since Thomas Hoccleve in the Fourteenth century (Burrow, 2013).

Syllabic poetry depends on syllables, but their phonemics is complicated. No simple algorithm identifies syllables (e.g., Ladefoged & Johnson, 2014), and puzzling cases occur, e.g., “sigher” seems to have two syllables, whereas “sire” seems to have one syllable, and yet both are pronounced in the same way. So, morphology matters: *sigh* + *er* versus *sire*. Nevertheless, poets and people can count syllables. And modern poets have used many syllabic verse forms in English, such as Haiku, a Japanese form of 17 syllables divided into lines of five, seven, and five syllables, as in Auden's:

Space was holy to
pilgrims of old, till the plane
stopped all that nonsense.

Meter in music is based on measures; meter in poetry is based on lines in verse (Fabb & Halle, 2008). The two have in common several factors. They can be counted—in beats per measure and in stresses or syllables per line. Musical notation distinguishes meter, stress, and rhythm. Normal writing has no explicit signs for them. Hence, poetic meter is less certain, and a line often has alternative scansion. One consequence is the immoderate literature on poetic prosody—far larger than that of its counterpart in music. Yet, poets are likely to learn meter from studying poetry, not poetics. They know *how* rather than *that*. They sometimes have no explicit knowledge of meter. Like families of rhythms in music, those in verse are prototypical. Not every iambic pentameter in Shakespeare has five stresses. That is why in traditional poetics, the treatment of lines as juxtapositions of feet is mistaken. The prototypical iambic pentameter tolerates exceptions (Brogan, 1993). As in music, the rhythm of the words in a poem can both corroborate a meter and depend on a meter for an assignment of their appropriate stresses.

Meter in poetry serves several interrelated aims. It imposes constraints on poets; and creation thrives on constraints (e.g., Haught, 2015). Hence Robert Frost's remark: “Writing free verse is like playing tennis with the net down” (Tuten & Zubizarreta, 2001, p. 318). In the information-theoretic sense (see Shannon, 1948), meter introduces *redundancy* into verse, which is therefore more predictable and easier to remember. And it has an emotional impact:

Just as in a crowd we are much more easily carried away by feeling than when alone, so metre excites us, prepares us to listen readily to what is being said. ... When a poet is writing verse, the feeling, as it were, excites the words and makes them fall into a definite group, going through dancing movements, just as feeling excites the different members of a crowd and makes them act together (Auden, 1977, p. 307).

Poetry based on regular meters, whether stresses or syllables, or both, excites attention, and makes communication easier. It is more memorable; it is more emotional. An experimental study showed that both meter and rhyme have emotional effects independent of semantic content. Participants rated various manipulations of four-line stanzas from German ballads, and the ratings showed that rhyme yielded greater

liking, intensity, and perceived and felt emotion than stanzas without rhyme (Obermeier et al., 2013). Ratings also showed that poems with meter are more likeable and more intense (Obermeier et al., 2016). This research derived from the theory of “cognitive fluency” according to which the ease of the perceptual identification of an object predicts a more positive aesthetic response (Reber et al., 2004). In contrast, the simulation theory concerns *which* emotions prosody evokes. Poetics has little to say on this topic, and so we return to the simulation theory.

4.3. Prosody and the predictions of emotions

According to the simulation theory, prosodic cues are mimetic. Rudimentary models of events suffice to evoke emotions—all it takes are models derived from expressions and behaviors typical of particular emotions. The mimetic process is much the same for music (Johnson-Laird & Oatley, 2008, 2016). Music that is soft, low pitched, slow in tempo, and slightly dissonant, tends to make people feel sad. That is because people who are sad tend to speak softly in a low pitch, to move slowly, and to behave as if in pain—musical dissonance is rooted in the mildly abrasive sound of adjacent vibrations on the cochlear in the inner ear, and in the culture of tonality (Johnson-Laird et al., 2012). Other musical cues elicit other basic emotions. To rate a piece of music as conveying an emotion does not necessarily mean that the individual who made the rating felt the emotion, but brain-imaging studies have corroborated that regions of the brain mediating emotions are active in appropriate ways in listening to music (e.g., Trainor & Schmidt, 2003).

As with music, so with prosody. The simulation theory predicts that prosodic cues can enhance or evoke emotions by yielding rudimentary models of the actions and states of mind of individuals in the grip of the four free-floating basic emotions: happiness, sadness, anger, and anxiety. Recitations of poems can exploit the ability of human speech to communicate emotions. At least five of its variables—speed, volume, pitch, intonation contour, and voice quality, distinguish among the four free-floating basic emotions (see, e.g., Ramdinmawii et al., 2017). Prosody, however, concerns those cues that occur in written poetry. They exclude speed of recitation, its volume, its intonation contour, and so on, but there remain four prosodic cues to particular emotions:

- meter, which can be relatively fast (three-syllable feet) or relatively slow (two-syllable feet)
- rhythm, which can be regular or irregular
- rhyme, which can be between adjacent lines or words as in alliteration and assonance, between more distant lines, or non-existent
- vowels, which can have a lowest formant high in pitch (e.g., “heed”) or low in pitch (e.g., “who’d”).

The first three of these cues can convey the speed of actions and thoughts (see Pronin et al., 2008). Individuals who are happy tend to move and to think at a medium pace; those who are sad tend to do so slowly. These cues yield a mimetic simulation that can evoke the corresponding emotions. The theory predicts one major effect of meter. In general, a sequence of two unstressed syllables takes about the same time to pronounce as a single stressed symbol. So, meters based on feet of three syllables in which two are unstressed should yield an impression of greater speed than those based on feet of two syllables in which at least one and perhaps both are stressed. Like music, a mimetic model of an upbeat meter should evoke happiness, or depending on the contents of the verse, anger or anxiety. In contrast, a slower meter should evoke sadness (cf. Eliot, 1932).

Any line of verse has a rhythm whether the line is metrical, syllabic, or free. It may be regular or irregular as in the rhythm of an action or a thought. Regularity is characteristic of happiness and sadness, whereas irregularity is characteristic of anger and anxiety. This cue distinguishes between these two pairs of emotions.

The temporal intervals between rhymes also cue the speed of action and thought. Rhymes within a line, and alliteration and assonance, or

Table 2

Mimetic cues to free-floating basic emotions in the prosody of poems. Empty cells signify that the simulation theory imposes no constraints on values, and adjacent rhyme includes alliteration and assonance.

Basic emotions	Prosodic cues			
	Meter	Rhythm	Rhyme	Vowel Pitch
Happiness	3-syllable feet	Regular	Adjacent	Medium
Sadness	2-syllable feet	Regular	distant, or none	Low
Anger	3-syllable feet	Irregular	–	High
Anxiety	3-syllable feet	Irregular	–	Low

between adjacent lines, elicit rapidity, and so mimesis evokes happiness, and, with appropriate contents, anger or anxiety. A longer interval between rhymes elicits slowness, and mimesis evokes sadness.

In principle, the pitch of the first formant in vowels could be a cue to emotions, because people who are angry or anxious tend to speak with greater emphasis, which calls for a rise in pitch, whereas those who are sad speak with a lower pitch. Of course, poems are seldom written using only a subset of vowels of a particular pitch. However, the poet Christian Bök’s (2001) *Eunoia* has five chapters each composed using only one of the five *written* vowels in English, and containing such sentences as, “Hassan can, at a handclap, call a vassal at hand and ask that all staff plan a bacchanal”. In spoken English, however, there are a dozen or more vowels, depending on dialect, and there are also diphthongs (glides from one pure vowel to another, as in, say, “say”). Even the preceding extract from Bök’s poem contains distinct spoken vowels in “a”, “can”, and “ask”. No experiment appears to have examined the emotional effects of verse in restricted sets of vowels differing in the pitch of their first formants. Because the contents of poems are crucial, and writing is imperfect in expressing prosody, cues such as meter and rhyme provide much less mimetic information about emotions than they do in music. Even music, however, has difficulty in distinguishing anger from anxiety.

Table 2 summarizes the theory’s predictions about the four free-floating basic emotions that prosody should evoke or enhance from mimetic simulations. The subsequent sections consider the evidence for those predictions that experiments have tested.

4.4. Emotional effects of meter and rhythm

The simulation theory predicts that meter should cue speed (see Table 2). Pope in his didactic *Essay on Criticism*, written in pairs of rhyming iambic pentameters (“heroic couplets”) advises poets:

When Ajax **strives** some **rock’s vast weight** to **throw**,
The **line** too **labours**, and the **words move slow**;
Not so, when **swift Camilla scours** the **plain**,
Flies o’er th’ **unbending corn**, and **skims** along the **main**.

Pope’s prosody mimics his advice. The opening couplet is dense with stresses, which slow down the poem; the second couplet is less dense with stresses, which speeds it up.

The simulation prediction is borne out in psychological experiments. In an impressive but seldom cited study, over 600 participants listened to recordings of poems constructed in nonsense words with English phonology and modeled on a real poem (Hevner, 1937). The versions of the poem varied in meter, vowels and consonants, and spoken intonation which was either “exaggerated” or “sedate”. The participants selected words denoting emotions to characterize the poems. These words were in sets concerning happiness, sadness, excitement, but omitted the other basic negative emotions of anger and anxiety. The major finding was that the poems varied in the emotional terms they elicited, and that the most effective variable was meter (see also Van Peer, 1990). For example, as their mimetic models predict, a meter with a three-syllable foot of two unstressed syllables tended to elicit “happiness” and its cognates, whereas a meter of a two-syllable foot

tended to elicit “sadness” and its cognates. These effects were corroborated in a subsequent study (Tedford & Synnott, 1972).

The simulation theory predicts that a deliberate violation of a meter that a poem has set up, results in an irregular rhythm that implies a disturbance in state of mind, such as a feeling of anger or anxiety. At the climax of Marlowe’s play *Dr. Faustus* when the devils come to drag him down to hell, the third line of his cry violates the preceding iambic pentameters:

The devil will come, and Faustus must be damn’d.
O, I’ll leap up to my God! Who pulls me down? –
See, see, where Christ’s blood streams in the firmament!

Prosody and content parallel the character’s anguish.

Hevner (1937) reported emotional effects of vowels in rhymes, referring to their pitch rather than to their formants: “ee” with a first formant of a high pitch tended to elicit selections of “light”, “leisurely”, “serene”, and “romantic”, whereas “oo” with a first formant of a lower pitch tended to elicit selections of “serious”, “dignified” and “emphatic” (see also Auracher et al., 2010). But, vowels of every sort occur in most poems and so can cancel out their evocations of emotion. And recent studies have failed to replicate emotional consequences of vowels (Kraxenberger & Menninghaus, 2016). Yet, a similar study of recitations did corroborate their prosodic cues in evoking happiness and sadness (Kraxenberger et al., 2018).

4.5. Emotional effects of rhyme

Most rhymes occur between words at the ends of adjacent lines or those near to one another. Normal rhymes have syllables with the same or similar vowels and sometimes the same or similar end consonants. There are multiple variants, and rhyme schemes define many forms of poem, such as the two sort of sonnet. *Alliteration* is the collocation of words with the same initial consonant, and *assonance* is the nearby placement of syllables with the same vowels. Hence, rhymes can combine alliteration and assonance. What they all boil down to is repetition. And so they aid memorability and attention, but they do not trigger the same invariable emotions. Children become sensitive to rhyme in their preschool years, and studies show that it elicits event-related potentials in the brain by age six (Coch et al., 2005). Alliteration in both poetry and prose, whether read aloud or silently, can reactivate memories for phonologically similar material (Lea et al., 2008).

The simulation theory predicts that adjacent rhymes and alliterations should convey a relatively upbeat tempo (see Table 2). The poet W. S. Gilbert exploited both of them in his lyrics for Arthur Sullivan’s music in their well-known comic operas, such as *The Mikado*. But Gilbert’s poems also used them, as *The practical joker* illustrates:

Oh, what a fund of joy jocund lies hid in harmless hoaxes,
What keen enjoyment springs
From cheap and simple things!
What deep delight from sources trite inventive humour coaxes,
That pain and trouble brew
For everyone but you!

The mimetic model of rapid fire evokes jollity.

Emotional effects of prosody occurred in a study of proverbs (Menninghaus et al., 2015). The proverbs varied in whether or not they had meter, rhyme, and succinct wording, and the participants rated them for comprehensibility, beauty, and concision (praegnantz). In broad terms, the presence of the three factors tended to increase ratings of beauty and concision, but to decrease ratings of ease of comprehension. A follow-up study showed that the effects on comprehension were a result of ambiguities in the poetic formulations (Wallot & Menninghaus, 2018). Ratings of comprehension may not match actual ease of understanding.

And, at least one other study of proverb-like sayings showed that rhyme seemed to make them easier to understand. Individuals judged an aphorism such as, “What sobriety conceals, alcohol reveals,” as more truthful than its non-rhyming counterpart: “What sobriety conceals, alcohol unmasks” (McGlone & Tofighbakhsh, 2000). The effect was smaller, however, when participants were told to separate poetic quality from semantic content. One interpretation of the phenomenon is that rhyming yields a greater fluency in processing, which could be mis-attributed to greater truthfulness. But, an alternative consistent with the results of Menninghaus et al. (2015) is that rhyme is a sign of authenticity: real proverbs rhyme, and real proverbs are more likely to be true.

The sadness that traditional forms of rhyme can evoke is illustrated in this sonnet by Edna St Vincent Millay (1988, p. 42):

What lips have kissed, and where, and why,
I have forgotten, and what arms have lain
Under my head till morning; but the rain
Is full of ghosts tonight, that tap and sigh
Upon the glass and listen for reply,
And in my heart there stirs a quiet pain
For unremembered lads that not again
Will turn to me at midnight with a cry.
Thus in the winter stands the lonely tree,
Nor knows what birds have vanished one by one,
Yet knows its boughs more silent than before:
I cannot say what loves have come and gone,
I only know that summer sang in me
A little while, that in me sings no more.

Its traditional iambic pentameters—apart for its first line, and in its static rhyme scheme (abba abba from the Petrarchian sonnet) amplify its sadness.

Particular words can contribute to effects of rhyme and alliteration. Gerard Manley Hopkins wrote in *Spring and Fall*:

Nor mouth had, no nor mind, expressed
What heart heard of, ghost guessed:
It is the blight man was born for,
It is Margaret you mourn for.

Davis (2019, p. 164) compares the first line with a more conventional expression of its content: “Your lips [or tongue] had not expressed this thought; nay, your mind not even entertained it”. And she comments on Hopkins’s actual line: “The effect ... of this compression and bluntness was to make the lines convey more emotion, as though they had been wrested from the speaker almost by force”.

Experiments have corroborated the effects of adjacent rhymes on emotion. Tsur (1996) compared participants’ ratings for Gray’s *Elegy written in a country churchyard*, which we quoted earlier, which has a rhyme scheme of abab, with a rearrangement of the lines to yield a rhyme scheme of aabb:

The curfew tolls the knell of parting day.
The plowman homeward plods his weary way.
The lowing herd wind slowly o’er the lea,
And leaves the world to darkness and to me.

If you compare how the two versions sound, you are likely to concur with the participants in the study. They rated this new version with adjacent rhymes as faster, wittier, and less emotional than the original version. The study did not assess the nature of the emotion. It seems likely, however, that the original *Elegy* evoked sadness, and the feeling was ameliorated in the version with adjacent rhymes.

In short, experiments have examined some of the simulation theory’s predictions in Table 2, and corroborated them. The music of poetry in its prosodic features, such as meter, rhythm, and rhyme, can elicit particular free-floating emotions, sometimes in experiments that use nonsense

verse with no semantic contents. With proper contents, however, appropriate prosody is likely to enhance emotions. And when the contents trigger a basic emotion, and prosody a different emotion, the result should be mixed feelings—as happened in analogous experiments with pure music containing mixed cues (see Johnson-Laird & Oatley, 2016). One major gap in the studies is that they have so far failed to examine differences among the negative emotions: sadness, anger, and anxiety. Voice quality can convey them in the absence of content (e.g., Ramdinmawii et al., 2017), and prosodic cues should enhance their evocation in poems.

5. The third simulation: aesthetics

When you encounter a poem for the first time—you hear Ginsberg recite *Howl*, or you read Auden's *Musée des Beaux Arts*—it may grip you in an intense excitement. Your attention is rapt in the words and in the images they inspire. Poets themselves report similar experiences in writing poems (e.g., Spender, 1952, p. 125). You and the poets are experiencing “flow” (Csikszentmihalyi & Csikszentmihalyi, 1992). You feel emotion, but you are too engrossed to be self-aware. When your excitement wanes, as Wordsworth (1800) wrote, you can stand back from the poem to recollect it in tranquility. Like any work of art, if the poem's beauty moves you, then you like it and you may even love it. Otherwise, you may be indifferent to it or hate it.

Theorists have raised at least three objections to the preceding account. Some have claimed that aesthetic reactions are intellectual, not emotional (e.g., Hanslick, 1957). Some have argued that poems and other fictions cannot evoke real emotions (e.g., Walton, 1990). And some have argued that aesthetic emotions have the same immediacy as your delight in an ice cream: they are simple hedonic emotions of pleasure or displeasure, and so theorists of emotion can bid “a farewell to art” (Skov & Nadal, 2020).

Most theories of aesthetics reject the preceding scepticism. They contrast the emotions of daily life with those evoked in aesthetic evaluations of works of art (e.g., Cupchik, 1994; Frijda, 2007; Marković, 2012; Scherer, 2005). The simulation theory concurs. Your intellectual evaluation of a poem evokes a complex aesthetic emotion combining a basic emotion with your assessment. The basic emotion can be love, hate, anger, anxiety, boredom, or disgust, in varying degrees and mixtures, which can elicit somatic responses, involuntary behaviors, and voluntary actions (see also Menninghaus et al., 2019). The evidence shows that aesthetic emotions are real: they activate brain systems that mediate emotions. This activation occurs in response to pure music that has no semantic content whatsoever (Trainor & Schmidt, 2003). One particular aesthetic emotion is awe—a complex mixture of love and fear—that goes beyond a simple hedonic reaction (for a review, see Keltner & Haidt, 2003). It can be accompanied with gooseflesh and tears, and it can elicit public applause (Konečni, 2005).

Simulation underlies your aesthetic evaluation of a poem. You are aware that *you* are reading and assessing a particular poem. And your self-awareness depends on a special sort of mental model: a model of yourself in a particular relation to the poem, namely, evaluating it and having an emotional reaction to it. The importance of models of the self is illustrated in the existence of robots that have such models. Robots need to know the locations of their various parts to avoid injuring themselves. And if their self-model represents damage to the robot itself, then that triggers a goal of seeking repair (Kwiatkowski & Lipson, 2019). Humans, moreover, can describe themselves with varying degrees of accuracy. A computational device can be programmed to print out a complete description of itself—the program takes some ingenuity in order to include its ability to print out its own description in its own self-description (Thatcher, 1970). Mental models of the self, in contrast, are vastly incomplete and often inaccurate. They are schematic, high-level, and embody folk psychology. They serve several purposes. They allow you to be aware that you are aware, to make intentional decisions, and to describe yourself, your motivations, your aspirations (see Ch. 16 of

Johnson-Laird, 1983). Likewise, when you are aware that you are reading a poem, you know that you are interacting, not with the mundane world—with its jobs, newspapers, and conflicts—but with a putative work of art. You are no longer rapt but, as Cupchik (2002) argues, at a psychological distance from the work. Indeed, you can be “clamped” to your environment, responding only to your perceptions of it, or you can suppress these responses in order to concentrate on your own thoughts (Glenberg, 1997). Aesthetic emotions are therefore to some degree self-conscious: you cannot experience them without being aware that you are doing so. Your model mediates your appreciation of a work's style, skill, and beauty, and so it can evoke an aesthetic emotion. You know that the experience of beauty tends not to happen often, and so you have the meta-knowledge that the poem has moved you. It will have done something to touch your “inner” state of mind (Starr, 2013; Vessel et al., 2013). In contrast, you can enjoy a good ice cream, just as your dog does—without standing back from the experience to become aware of that you are having an emotional reaction.

A similar conclusion follows from a different starting point—those theories that base emotions on the dimensions of arousal and pleasure. Aesthetic emotions concern goals; and beautiful entities can sometimes induce awe and give pleasure, because they reshape and expand knowledge (Armstrong & Detweiler-Bedell, 2008). This approach and the simulation theory concur that an aesthetic emotion depends on, and in turn can affect, knowledge. You cannot appreciate the style, skill, and beauty of a poem without knowing something about poetry. You have to understand the poem to some degree—though there is no end to understanding, and different individuals make different interpretations (Holyoak, 2019, Ch. 2). A failure to grasp a meaning for a poem vitiates its appreciation (Peskin, 1998). But, if you do understand it, at least in part, then it may move you, by way of its content, prosody, and skill. The final step may be that you experience an aesthetic emotion, which depends on your assessment of the poem. Your knowledge of the genre of the poem with its conventions and constraints, and even the work of the individual poet, contribute to your assessment. A profound poem is one that affects what Frijda (2007) referred to as a “concern”: the aesthetic emotion in turn modifies your knowledge of the poet and the poem. And it can even alter your model of yourself.

6. Conclusions

Emotions have ancient evolutionary origins, and so simulations in primitive mimetic models can evoke them. They can be basic and free-floating (see Table 1). That is why music and poetic prosody, which has semantic content, can be moving. With caveats, the simulation theory seems to outline the general principles of the evocation of emotions from a poem. It invokes three sorts of simulation.

First, insofar as a poem is written in a natural language, its comprehension depends on a compositional semantics that represents the meanings of its clauses. They together with the referential relations among them in temporal, causal, and intentional frameworks, yield a simulation model of the poem's contents. Special processes must underlie models of metaphors and other tropes. Semantic interpretation itself depends on simulation, such as action-based representations, e.g., “kick” invokes kicking (Glenberg & Kaschak, 2002). And, as Pickering and Garrod (2013) emphasize, the comprehension of discourse depends on the simulation of its production—a process sometimes referred to as “analysis by synthesis” (e.g., Bever & Poeppel, 2010). Readers can then look through Orwell's window-pane at a model of events in the world of the poem, which in turn evokes emotions. This step occurs in reading fiction, in viewing a representational painting, and in looking through a real window. Readers experience the basic and complex emotions of the protagonist and others in the poem, and they can feel sympathy for them and even empathize with them.

Second, emotions can be enhanced and even perhaps be triggered from a Joycean reading of the surface of the poem. Its prosodic cues such as meter, rhythm, and rhyme, yield a mimetic model. It can evoke basic

Table 3
The role of three simulation models in evoking emotions from poetry.

Sort of simulation	Basis of simulation	Nature of evoked emotions
1. Model of a poem's content	Compositional semantics, referential links, and content of discourse	Basic and complex emotions, empathy or sympathy for persons in the poem
2. Mimetic model of a poem's surface	Prosodic cues such as meter, rhythm, and rhyme	Basic 'free floating' emotions: happiness, sadness, anger, anxiety
3. Model of self in relation to poem	Knowledge of self, and knowledge of poetry	Complex aesthetic emotions of which one is aware in relation to the poem

'free-floating' emotions that can occur with or without knowledge of their causes or objects. Their principal cues are summarized in Table 2. The frequent occurrence of events in unit time, such as rhymes, can enhance feelings of joy; whereas their rarer occurrence in unit time can enhance sadness. Such prosodic cues in poems—even those made up from nonsense words—provide a striking corroboration of this prediction.

Third, models can simulate the self. Individuals can then be aware that they are reading or listening to a poem, and they can use their knowledge to assess its beauty and skill, or lack thereof. They may experience a complex emotional experience—an aesthetic emotion, which in turn modifies their model of themselves. Table 3 presents a summary of the three sorts of simulation.

We have mentioned various parallels to the simulation theory, such as the account of aesthetic emotions due to Menninghaus et al. (2019), which dovetails with empirical studies at the Max Planck Institute for Empirical Aesthetics. Another parallel is the "the mood empathy" hypothesis, according to which poems expressing moods based on individuals, situations, or entities, can lead readers to envisage these states of affairs and to "resonate" with their emotions (Jacobs et al., 2016; Lüdtke et al., 2014). This account concerns how the contents of poems and prose elicit emotions (see also Mar et al., 2011; Oatley, 1994). Its empirical focus is on readers' moods – whether elevated or depressed, aroused or subdued, and wakeful or sleepy – and on whether or not they experienced an aesthetic liking of the poem. The theory invokes the simulation of moods, but does not aim to account for the cues that evoke particular emotions.

The corroborations of the simulation theory include some surprising results. But each of the three sorts of simulation needs more empirical investigation. The theory predicts that the emotions that poetry evokes should be more intense than those of prose that is without prosody. A future test of this hypothesis needs to hold contents as similar as possible between these two sorts of vehicle. Prosody itself has been shown to elicit emotions in Hevner's (1937) remarkable study. But, it calls for a replication in which meter, rhythm, and rhyme, are manipulated in order to examine their effects on all four free-floating basic emotions: happiness, sadness, anger, and anxiety. The corroboration of the theory's predictions (in Table 2) demands the development of computer model that predicts the emotions that prosodic cues alone are likely to evoke. The evidence for models that simulate the self and their role in aesthetic emotions is almost non-existent. Various potential indices of the capacity to access such models exist, such as the ability to envisage other people's beliefs and how they differ from one's own (Leslie et al., 2004). The simulation theory predicts that the accessibility of self-models correlates with the experience of aesthetic emotions.

The simulation theory provides a psychological underpinning for cognitive poetics (e.g., Stockwell, 2019). It is compatible with several investigations of the brain circuits underlying the experience of poetry in neuro-aesthetic theories (e.g., Jacobs, 2015; Koelsch et al., 2015; Starr, 2013). To sum up the theory, three sorts of mental model prompt emotions from a verse. They can simulate its world, mimic rhythm, meter, rhyme, and make conscious its beauty.

CRediT authorship contribution statement

Philip N. Johnson-Laird: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Keith Oatley:** Conceptualization, Methodology, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no conflict of interesting arising from this research article.

Acknowledgements

We thank Keith Holyoak, Dorothy Johnson-Laird, Maureen Johnson-Laird, Gill Nicholson, and Michael Kaschak and an anonymous reviewer for helpful advice.

References

- Allen, G. (1975). Speech rhythm: Its relation to performance universals and articulatory timing. *Journal of Phonetics*, 3, 75–86.
- Armstrong, T., & Detweiler-Bedell, B. (2008). Beauty as an emotion: The exhilarating prospect of mastering a challenging world. *Review of General Psychology*, 12, 305–329. <https://doi.org/10.1037/a0012558>
- Auden, W. H. (1977). In E. Mendelson (Ed.), *The English Auden*. London: Faber & Faber.
- Auden, W. H., & Garrett, J. (1935). *The poet's tongue: An anthology*. London: G. Bell.
- Auracher, J., Albers, S., Zhai, Y., Gareeva, G., & Stavniychuk, T. (2010). P is for happiness, N is for sadness: Universals in sound iconicity to detect emotions in poetry. *Discourse Processes*, 48, 1–25. <https://doi.org/10.1080/01638531003674894>
- Bentley, E. C. (2014). *Biography for beginners* (3rd ed.). Mineola, NY: Dover books (Originally published 1905.).
- Bever, T. G., & Poeppel, D. (2010). Analysis by synthesis: A (re-) emerging program of research for language and vision. *Biolinguistics*, 4(2–3), 174–200.
- Bloomfield, M. W. (1986). Poetry in early societies. *Proceedings of the American Philosophical Society*, 130, 247–250.
- Bök, C. (2001). *Eunoia*. Toronto, ON: Coach House Books.
- Brogan, T. V. F. (1993). Meter. In A. Preminger, & T. V. F. Brogan (Eds.), *The new Princeton encyclopedia of poetry and poetics* (pp. 768–783). Princeton, NJ: Princeton University Press.
- Bucciarelli, M., Mackiewicz, R., Khemlani, S. S., & Johnson-Laird, P. N. (2016). Children's creation of algorithms: Simulations and gestures. *Journal of Cognitive Psychology*, 28, 297–318.
- Burrow, J. A. (2013). Some final –es in the Hoccleve autographs. In M. Calabrese, & S. H. A. Shepherd (Eds.), *Yee? Baw for Bokes: Essays on medieval manuscripts and poetics in honor of Hoyt N. Duggan* (pp. 45–53). Los Angeles, CA: Marymount Institute Press.
- Byrne, R. M. J. (2005). *The rational imagination: How people create alternatives to reality*. Cambridge, MA: MIT Press.
- Byrne, R. M. J., & Johnson-Laird, P. N. (2019). If and or: Real and counterfactual possibilities in their truth and probability. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 46, 760–780.
- Cao, E., Lotstein, M., & Johnson-Laird, P. N. (2014). Similarity and families of musical rhythms. *Music Perception*, 31, 444–469.
- Clark, J., Yallop, C., & Fletcher, J. (2007). *An introduction to phonetics and phonology* (3rd ed.). Oxford: Blackwell.
- Coch, D., Grossi, G., Skendzel, W., & Neville, H. (2005). ERP nonword rhyming effects in children and adults. *Journal of Cognitive Neuroscience*, 17, 168–182.
- Craik, K. (1943). *The nature of explanation*. Cambridge: Cambridge University Press.
- Crowhurst, M. J. (2020). The iambic/trochaic law: Nature or nurture? *Language and Linguistics Compass*, 14, Article e12360.
- Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1992). *Optimal experience: Psychological studies of flow in consciousness*. Cambridge: Cambridge University Press.
- Cupchik, G. C. (1994). Emotion in aesthetics: Reactive and reflective models. *Poetics*, 23, 177–188.
- Cupchik, G. C. (2002). The evolution of psychical distance as an aesthetic concept. *Culture and Psychology*, 8, 155–187.
- Cupchik, G. C., Oatley, K., & Vorderer, P. (1998). Emotional effects of reading excerpts from short stories by James Joyce. *Poetics*, 25, 363–377.
- Cutler, A., & Foss, D. J. (1977). On the role of sentence stress in sentence processing. *Language and Speech*, 20, 1–10.
- Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago, IL: University of Chicago Press (Original work published in 1872.).
- Davis, L. (2010). *The collected stories of Lydia Davis*. New York: Picador.
- Davis, L. (2019). *Essays one*. New York: Farrar, Strauss and Giroux.
- Djikic, M., & Oatley, K. (2014). The art in fiction: From indirect communication to self-development. *Psychology of Aesthetics, Creativity and the Arts*, 8, 498–505.
- Djikic, M., Oatley, K., & Carland, M. (2012). Genre or artistic merit: The effect of literature on personality. *Scientific Study of Literature*, 2(25), 36.
- Eliot, T. S. (1921). Hamlet and his problems. In *The sacred wood*. New York: Alfred A. Knopf.

- Eliot, T. S. (1932). *The metaphysical poets*. In *Selected essays*. London: Faber & Faber.
- Empson, W. (2004). *Seven types of ambiguity*. New York: Random House. Originally published, 1930.
- Fabb, N., & Halle, M. (2008). *Meter in poetry: A new theory*. Cambridge: Cambridge University Press.
- Freedberg, D., & Gallese, V. (2007). Motion, emotion and empathy in esthetic experience. *Trends in Cognitive Sciences*, 11, 197–203.
- Frijda, N. H. (2007). *The laws of emotion*. Mahwah, NJ: Erlbaum.
- Garnham, A. (1987). *Mental models as representations of discourse and text*. Chichester: Ellis Horwood.
- Garnham, A. (2021). Opinion piece: How people structure representations of discourse. *Dialogue & Discourse*, 12, 1–20.
- Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Sciences*, 20(1), 1–19.
- Glenberg, A. M., & Kaschak, M. P. (2002). Grounding language in action. *Psychonomic Bulletin & Review*, 9, 558–565.
- Glucksberg, S. (2001). *Understanding figurative language: From metaphors to idioms*. Oxford: Oxford University Press.
- Hanauer, D. (2001). What we know about reading poetry. Theoretical positions and empirical research. In G. Steen, & D. Schram (Eds.), *The psychology and sociology of literature* (pp. 107–128). Amsterdam and Philadelphia: John Benjamins.
- Hanslick, E. (1957). In G. Cohen (Ed.), *The beautiful in music* (7th ed.). New York: The Liberal Arts Press (Original work published 1854; this ed. originally published in 1885).
- Haight, C. (2015). The role of constraints in creative sentence production. *Creativity Research Journal*, 27, 160–166.
- Hay, J. S. F., & Diehl, R. L. (2007). Perception of rhythmic grouping: Testing the iambic/trochaic law. *Perception and Psychophysics*, 69, 113–122.
- Hevner, K. (1937). An experimental study of the affective value of sounds in poetry. *American Journal of Psychology*, 49, 419–434.
- Hoeben Mannaert, L. N., Dijkstra, K., & Zwaan, R. A. (2020). Object combination in mental simulations. *Quarterly Journal of Experimental Psychology*, 73(11), 1796–1806.
- Hogan, P. C. (2018). *Literature and emotion*. New York: Routledge.
- Holyoak, K. J. (2019). *The spider's thread: Metaphor in mind, brain, and poetry*. Cambridge, MA: MIT Press.
- Jacobs, A. M. (2015). Neurocognitive poetics: Methods and models for investigating the neuronal and cognitive-affective bases of literature reception. *Frontiers in Human Neuroscience*, 9, 186. <https://doi.org/10.3389/fnhum.2015.00186>
- Jacobs, A. M., Lüdtke, J., Aryani, A., Meyer-Sickendieck, B., & Conrad, M. (2016). Mood-empathic and aesthetic responses in poetry reception: A model-guided, multilevel, multimethod approach. *Scientific Study of Literature*, 6, 87–130.
- Jakobson, R. (1960). Linguistics and poetics. In T. A. Sebeok (Ed.), *Style in language* (pp. 350–377). New York, NY: Wiley.
- Johnson-Laird, P. N. (1983). *Mental models*. New York: Cambridge University Press.
- Johnson-Laird, P. N., Bucciarelli, M., Mackiewicz, R., & Khemlani, S. S. (2021). Recursion in programs, thought, and language. *Psychonomic Bulletin and Review*. <https://doi.org/10.3758/s13423-021-01977-y>. published online Dec 2021.
- Johnson-Laird, P. N., Kang, O. E., & Leong, Y. C. (2012). On musical dissonance. *Music Perception*, 30, 19–35.
- Johnson-Laird, P. N., Mancini, F., & Gangemi, A. (2006). A hyper emotion theory of psychological illnesses. *Psychological Review*, 113, 822–841.
- Johnson-Laird, P. N., & Oatley, K. (2016). Emotions in music, literature, and film. In L. F. Barrett, M. Lewis, & J. Haviland-Jones (Eds.), *Handbook of emotions* (4th ed., pp. 82–97). New York: Guilford.
- Johnson-Laird, P. N., & Oatley, K. (2021). Emotions, simulation, and abstract art. *Art and Perception*, 1–33. <https://doi.org/10.1163/22134913-bja10029>
- Johnson-Laird, P. N., & Oatley, K. J. (2008). Emotions, music, and literature. In M. Lewis, J. Haviland-Jones, & L. F. Feldman-Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 102–113). New York: Guilford Press.
- Johnson-Laird, P. N., & Stevenson, R. (1970). Memory for syntax. *Nature*, 227, 412.
- Kant, I. (1951). *Critique of judgment*. New York: Hafner (Original work published 1790).
- Keats, J. (1816–20). In D. Bush (Ed.), *Selected poems and letters by John Keats*. New York: Houghton Mifflin (current edition 1959).
- Keltner, D., & Haidt, J. (2003). Approaching awe, a moral, spiritual, and aesthetic emotion. *Cognition and Emotion*, 17(2), 297–314.
- Khemlani, S., Lotstein, M., & Johnson-Laird, P. N. (2015). Naive probability: Model-based estimates of unique events. *Cognitive Science*, 39, 1216–1258.
- Khemlani, S. S., Mackiewicz, R., Bucciarelli, M., & Johnson-Laird, P. N. (2013). Kinematic mental simulations in abduction and deduction. *Proceedings of the National Academy of Sciences*, 110, 16766–16771. <http://www.pnas.org/cgi/doi/10.1073/pnas.1316275110>.
- Kintsch, W., & van Dijk, T. A. (1983). *Strategies of discourse comprehension*. New York: Academic Press.
- Koelsch, S., Jacobs, A. M., Menninghaus, W., Liebal, K., Klann-Delius, G., Von Scheve, C., & Gebauer, G. (2015). The quartet theory of human emotions: An integrative and neurofunctional model. *Physics of Life Reviews*, 13, 1–27.
- Konečni, V. J. (2005). The aesthetic trinity: Awe, being moved, thrills. *Bulletin of Psychology and the Arts*, 5(2), 27–44.
- Kraxenberger, M., & Menninghaus, W. (2016). Mimological reveries? Disconfirming the hypothesis of phono-emotional iconicity in poetry. *Frontiers in Psychology*, 7, 1779. <https://doi.org/10.3389/fpsyg.2016.01779>
- Kraxenberger, M., Menninghaus, W., Roth, A., & Scharinger, M. (2018). Prosody-based sound-emotion associations in poetry. *Frontiers in Psychology*, 9, 1284.
- Kwiatkowski, R., & Lipson, H. (2019). Task-agnostic self-modeling machines. *Science Robotics*, 4, eaau9354.
- Ladefoged, P., & Johnson, K. (2014). *A course in phonetics*. Toronto, Canada: Nelson Education.
- Lakoff, G., & Turner, M. (1989). *More than cool reason: A field guide to poetic metaphor*. Chicago: University of Chicago Press.
- Lea, R. B., Rapp, D. N., Elfenbein, A., Mitchel, A. D., & Romine, R. S. (2008). Sweet silent thought: Alliteration and resonance in poetry comprehension. *Psychological Science*, 19, 709–716.
- Lerdahl, F. (2001). The sounds of poetry viewed as music. *Annals of the New York Academy of Sciences*, 930, 337–354.
- Leslie, A. M., Friedman, O., & German, T. P. (2004). Core mechanisms in 'theory of mind'. *Trends in Cognitive Sciences*, 8, 528–533.
- Longuet-Higgins, H. C. (1987). The perception of music. In *Mental processes: Studies in cognitive science* (pp. 169–187). Cambridge, MA: MIT Press (Originally published 1979.).
- Lüdtke, J., Meyer-Sickendieck, B., & Jacobs, A. M. (2014). Immersing in the stillness of an early morning: Testing the mood empathy hypothesis of poetry reception. *Psychology of Aesthetics, Creativity, and the Arts*, 8, 363.
- Mar, R. A., Oatley, K., Djikic, M., & Mullin, J. (2011). Emotion and narrative fiction: Interactive influences before, during, and after reading. *Cognition & Emotion*, 25, 818–833. <https://doi.org/10.1080/02699931.2010.515151>
- Marković, S. (2012). Components of aesthetic experience: aesthetic fascination, aesthetic appraisal, and aesthetic emotion. *i-Percept*, 3, 1–17.
- Marr, D. (1982). *Vision*. San Francisco: W.H. Freeman.
- McGlone, M. S., & Tofiqbaksh, J. (2000). Birds of a feather flock conjointly: Rhyme as reason in aphorisms. *Psychological Science*, 11, 424–428. <https://doi.org/10.1111/1467-9280.00282>
- Menninghaus, W. (2019). *Aesthetics after Darwin: The multiple origins and functions of the arts*. Boston, MA: Academic Studies Press.
- Menninghaus, W., Bohrn, I. C., Knoop, C. A., Kotz, S. A., Schlotz, W., & Jacobs, A. M. (2015). Rhetorical features facilitate prosodic processing while handicapping ease of semantic comprehension. *Cognition*, 143, 48–60.
- Menninghaus, W., Wagner, V., Knoop, C. A., & Scharinger, M. (2018). Poetic speech melody: A crucial link between music and language. *PLoS One*, 13(11).
- Menninghaus, W., Wagner, V., Wassiliwizky, E., Jacobsen, T., & Knoop, C. A. (2017). The emotional and aesthetic powers of parallelistic diction. *Poetics*, 63, 47–59.
- Menninghaus, W., Wagner, V., Wassiliwizky, E., Schindler, I., et al. (2019). What are aesthetic emotions? *Psychological Review*, 126, 171–195.
- Metzler, J., & Shepard, R. N. (1982). Transformational studies of the internal representations of three-dimensional objects. In R. N. In Shepard, & L. A. Cooper (Eds.), *Mental images and their transformations* (pp. 25–71). Cambridge, MA: MIT Press.
- Millay, E. S. V. (1988). *Collected sonnets: Edna St Vincent Millay*. New York: Harper and Row.
- Oatley, K. (1994). A taxonomy of the emotions of literary response and a theory of identification in fictional narrative. *Poetics*, 23, 53–74.
- Oatley, K. (2002). Emotions and the story worlds of fiction. In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 39–69).
- Oatley, K. (2004). Scripts, transformations, and suggestiveness, of emotions in Shakespeare and Chekhov. *Review of General Psychology*, 8, 323–340.
- Oatley, K. (2011). *Such stuff as dreams: The psychology of fiction*. Oxford: Wiley-Blackwell.
- Oatley, K. (2016). Fiction: Simulation of social worlds. *Trends in Cognitive Sciences*, 20, 618–628.
- Oatley, K., & Johnson-Laird, P. N. (1987). Towards a cognitive theory of emotions. *Cognition and Emotion*, 1, 29–50.
- Oatley, K., & Johnson-Laird, P. N. (2014). Cognitive approaches to emotions. *Trends in Cognitive Sciences*, 18, 134–140.
- Obermeier, C., Kotz, S. A., Jessen, S., Raettig, T., von Koppenfels, M., & Menninghaus, W. (2016). Aesthetic appreciation of poetry correlates with ease of processing in event-related potentials. *Cognitive, Affective, & Behavioral Neuroscience*, 16, 362–373.
- Obermeier, C., Menninghaus, W., Von Koppenfels, M., Raettig, T., Schmid-Kassow, M., Otterbein, S., & Kotz, S. A. (2013). Aesthetic and emotional effects of meter and rhyme in poetry. *Frontiers in Psychology*, 4, Article 10.
- Orwell, G. (1970). Why I write. In S. Orwell, & I. Angus (Eds.), *The collected essays, journalism and letters of George Orwell* (Vol. 1, pp. 23–30). Harmondsworth, Middlesex: Penguin (Originally published in 1945.).
- Peskin, J. (1998). Constructing meaning when reading poetry: An expert-novice study. *Cognition and Instruction*, 16, 235–263.
- Pessoa, L., & Pereira, M. G. (2013). Cognition-emotion Interactions: A review of the functional magnetic resonance imaging literature. In M. D. Robinson, E. Watkins, & Harmon-Jones (Eds.), *Handbook of cognition and emotion* (pp. 55–68). NY: Guilford Press.
- Pickering, M. J., & Garrod, S. (2013). An integrated theory of language production and comprehension. *Behavioral and Brain Sciences*, 36(4), 329–347.
- Plato. (1961). In E. Hamilton, & H. Cairns (Eds.), *The collected dialogues*. Princeton, NJ: Princeton University Press.
- Power, A. (1974). *Conversations with James Joyce*. NY: Barnes & Noble.
- Pronin, E., Jacobs, E., & Wegner, D. M. (2008). Psychological effects of thought acceleration. *Emotion*, 8, 597–612.
- Proust, M. (1913–1927). *À la recherche du temps perdu (In search of lost time)*. London: Penguin (Current edition 2003).
- Pushkin, A. (2008). In S. Mitchell (Ed.), *Eugene onegin*. London: Penguin (Originally published, 1833.).
- Ragni, M., & Johnson-Laird, P. N. (2021). Reasoning about epistemic possibilities. *Acta Psychologica*, 208, Article 103081. <https://doi.org/10.1016/j.actpsy.2020.103081>
- Ramdinmawii, E., Mohanta, A., & Mittal, V. K. (2017). Emotion recognition from speech signal. In *TENCON 2017, IEEE Region 10 Conference, Penang* (pp. 1562–1567).

- Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, 8, 364–382. https://doi.org/10.1207/s15327957pspr0804_3
- Rips, L. J. (1994). *The psychology of proof*. Cambridge, MA: MIT Press.
- Rothermich, K., Schmidt-Kassow, M., & Kotz, S. A. (2012). Rhythm's gonna get you: Regular meter facilitates semantic sentence processing. *Neuropsychologia*, 50, 232–244.
- Russell, J. A. (2003). The psychological construction of emotion. *Psychological Review*, 110, 145–172.
- Sappho. (circa 550 BCE/1993). In J. Balmer (Ed.), *Poems and fragments*. New York: Carol Publishing Group.
- Schank, R. C., & Berman, T. R. (2002). The pervasive role of stories in knowledge and action. In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 287–313). Mahwah, NJ: Erlbaum.
- Scherer, K. R. (2005). What are emotions? And how can they be measured? *Social Science Information*, 44, 695–729.
- Shannon, C. E. (1948). A mathematical theory of communication, part I. *Bell Systems Technical Journal*, 27, 379–423.
- Simon, H. A. (1967). Motivational and emotional controls of cognition. *Psychological Review*, 74, 29–39.
- Skov, M., & Nadal, M. (2020). A farewell to art: Aesthetics as a topic in psychology and neuroscience. *Perspectives on Psychological Science*. <https://doi.org/10.1177/1745691619897963>
- Sparrow. (2005). In M. Boon (Ed.), *America: A prophecy*. New York: Soft Skull Press.
- Spender, S. (1952). The making of a poem. In B. Ghiselin (Ed.), *The creative process: Reflections on invention in the arts and sciences* (pp. 113–126). Los Angeles: University of California Press (Originally published, 1946.).
- Starr, G. G. (2013). *Feeling beauty: The neuroscience of aesthetic experience*. Cambridge, MA: IT Press.
- Stockwell, P. (2019). *Cognitive poetics: A new introduction* (2nd ed.). London: Routledge.
- Tedford, W. H., & Synnott, C. S. (1972). Use of the semantic differential with poetic forms. *Psychological Record*, 22, 369–373.
- Thatcher, J. W. (1970). Self-describing turing machines and self-reproducing cellular automata. In A. W. Burks (Ed.), *Essays on cellular automata* (pp. 103–131). Champaign, Urbana: University of Illinois Press.
- Tillmann, B., & Dowling, W. J. (2007). Memory decreases for prose, but not for poetry. *Memory & Cognition*, 35, 628–639.
- Trainor, L. J., & Schmidt, L. A. (2003). Processing emotions induced by music. In I. Peretz, & R. J. Zatorre (Eds.), *The cognitive neuroscience of music* (pp. 310–324). Oxford: Oxford University Press.
- Tsur, R. (1996). Rhyme and cognitive poetics. *Poetics Today*, 17, 55–87.
- Tuten, N. L., & Zubizarreta, J. (2001). *The Robert frost encyclopedia*. Westport, CN: Greenwood Press, 9780313294648.
- Valéry, P. (1977). *Paul Valéry, an anthology*. London: Routledge & Kegan Paul.
- Van Peer, W. (1990). The measurement of metre: Its cognitive and affective functions. *Poetics*, 19, 259–275.
- Vessel, E. A., Starr, G. G., & Rubin, N. (2013). Art reaches within: Aesthetic experience, the self and the default mode network. *Frontiers in Neuroscience*, 7, 258.
- Wallot, S., & Menninghaus, W. (2018). Ambiguity effects of rhyme and meter. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 44, 1947–1954. <https://doi.org/10.1037/xlm0000557>
- Walton, K. L. (1990). *Mimesis as make-believe: On the foundations of the representational arts*. Cambridge, MA: Harvard University Press.
- Wordsworth, W. (1800). *Lyrical ballads with other poems* (2nd ed.). London: Longman and Rees.
- Yeats, W. B. (1999). Autobiographies. In W. H. O'Donnell, & D. N. Archibald (Eds.), *III. Collected works*. New York: Scribner (Originally published 1922.).
- Zwaan, R. A. (2016). Situation models, mental simulations, and abstract concepts in discourse comprehension. *Psychonomic Bulletin & Review*, 23(4), 1028–1034.
- Zwaan, R. A., & Radvansky, G. A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, 123(2), 162–185.