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An Experimental Appraisal of the Acquisition of Creative Literary Compression versus Descriptive Texts

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ABSTRACT

This paper argues that compression is a hallmark of creativity, demonstrating the effect of the process of compression and decompression on the cultivation of creative potentials. This study also suggests some cognitive strategies by which creative literary compression can be encoded and decoded in the light of some relevant theories. In order to raise the creative, cognitive potentials of compression and decompression, this research puts a compressed text in an experimental contrast with a detailed, descriptive text and examines how both address the minds and creative thinking of the research subjects. The research tests the differences between the impact of the two types of literary texts by measuring both the conceptual and linguistic outputs of the participants. The results support the hypothesis that tackling compressed texts deliberately through the cognitive process of decompression generates higher divergent thinking and encourages participants to translate their ideational processes into more creative writing.

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Introduction

This study sets off from Shakespeare's famous maxim "brevity is the soul of wit" (II. ii. 90) and Turner's treatment of compression as "a hallmark of art" (2006, p. 93). It argues that compression lies at the core of creativity, and it is prevalent in all arts, either visual, audible, or word-based. Compression means not only simple brevity but also concentration of high ideational density into a sparse space or medium. Creative compression reduces the linguistic and morphological medium of a text or constituent components of an artwork in general without reducing the density of its data transmission. In other words, the value of a creatively compressed work lies in its use of a minimized material, words, or elements, and its ability to maintain the same significance of the message conveyed to the recipient. Thus, through suggestion, under-telling and insinuation, a compressed, laconic message, which is creatively devised, can convey a considerable weight of significance and urge the recipient to think in divergent directions. Though the creative potentials of the cognitive capacity of compression and decompression are emphasized by prominent cognitivists (Dancygier & Sweetser, 2014; Fauconnier & Turner, 2002; Turner, 2006, 2014), this cognitive capacity has not received the due attention in creativity studies. Accordingly, this study reveals how tackling creatively compressed literary works can cultivate divergent thinking and creative writing. Thus, it focuses on the encoding and decoding of compression as cognitive processes which "may interact with or even support DT [divergent thinking]" (Runco & Acar, 2012, p. 70).

This study attempts to expand Turner and Fauconnier's concept of compression (2002) which is tackled within the limited frame of the conceptual integration/blending theory and studies compression in the light of other relevant theories which can offer novel dimensions and strategies for the formation and understanding of creative literary compression. This paper also experimentally assesses the capacity of compression as a stimulus to creative potentials. In order to bring out the distinctive, cognitive features of compression, this research put a compressed text in an experimental contrast with a detailed, descriptive text and examined how both addressed the minds of the research subjects. The experiment of this study used the between-groups design which entailed the testing of one factor in each group, the reading of a descriptive text in the control group, and the reading of a compressed text in the experimental group. The research subjects sample was (n = 125)

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- My experiment which involved human participants was conducted after receiving an official agreement from the council of Department of English Language and Literature. If required, I declare my readiness to present all official documents concerning this procedure.

Supplemental data for this article can be accessed on the publisher's website.

university students in the fourth year at Suez University, majoring in English Language and Literature. Two measures, conceptual and linguistic, were used in order to investigate the different impacts of the two factors on the participants' creative writing and divergent thinking skills.

It is noteworthy that compression is not confined to short, concise works such as short stories and poems, but even in longer works there are moments of remarkable compression always signaling the point of illumination which compresses the message of a long work in a concise statement or scene which is esthetically attention-grabbing and memorable. Consider, for example, Hamlet's utterance "To be or not to be that is the question" (Shakespeare, 1985/2003, III. i. 56). What makes this statement so brilliant is compression; a few words express surprisingly complex thoughts and carry an intensive message summing up the whole tragedy and dilemma of the protagonist.

Compression has two dimensions. First, compression enables the writers to squeeze extended ideas into an accessible human scale. Second, decompression allows the reader to decode compressed forms into a larger mental web with intricate relations.

Literature review

The value of compression in previous studies

Compression is a significant issue common in several scientific fields, such as information technology, cognitive science, literature, etc. Although most studies differ in their methodology and aims, they all agree on the basic concept of compression as a strategy by which the redundant and cumbersome is made laconic, intensive, and legible (Carter, 2003; Chaitin, 2010; Fauconnier & Turner, 2008; Hemingway and Plimpton, 1958; Karam, 2020; Leech, 1969). According to information theory, Chaitin (2010, p. 131) argued that any message can be understood only if its sign system and the program of calculating it are "much smaller than the data it explains." He also pointed out that "understanding is compression, comprehension is compression" (2010, p. 130). A compressed passage transfers data efficiently as it is concentrated and irredundant, thus more comprehensible. According to the communication theory, the communicative experience can be summed up in the conceptual mapping between two minds, the sender and the recipient, via a transmitted communicative message. The most fundamental problem of communication theory is the efficiency of transmission which depends to a great extent on data compression (Carter, 2003). If the writer wants to send a particular message, he should find out the shortest stream of symbols he can use to convey that message fully. Cumbersome data lie obstructively between the two human agents of the equation distancing both and delaying the delivery of message. On the contrary, a concise and to-the-point message is more manageable, bringing the two minds into a closer contact, so it keeps the reader engaged in an intensive intellectual exchange. In memory studies, compression enhances memory because the capacity of storage can be effectively enlarged through data compression. "If memories were stored in detail and the details had to match exactly, mental search would be slow and rarely successful" (Boyd, 2014, p. 21). People store experiences in a compressed form, but when they retrieve or recall them to the conscious, they become expandable and unfold into an expansive network of ideas connecting them to a vast mental web.

In literature, the significance of compression is stressed by many critics and writers. Poe (2012) emphasized that compression and brevity in fiction maintain "the immense force derivable from totality" (p. 526). He also elaborated: "In the brief tale, however, the author is enabled to carry out the fullness of his intention, be it what it may" (2012, p. 526). Hemingway invented a literary writing technique called the iceberg theory mainly for the sake of compression. He indicated that compression and omission of superfluous data are indispensable to the efficiency of message transmission. In his interview with *The Paris Review* in 1958, he explained: "I always try to write on the principle of the iceberg … to eliminate everything unnecessary to conveying experience to the reader" (Hemingway and Plimpton, 1958). Accordingly, data are omitted not because they are less important than the stated ones but because they are logically, relatively, and causally inferable. Pound (1968) argued that the "language beyond metaphor" is associated with ellipsis and compression, so it is more engaging and thought-provoking (p. 158). Leech (1969, p. 78) confirmed: "to compress, to say much in little, is the means to poetic intensity, and the mark of great poetry." Accordingly, compression is a highly creative, artistic activity because the mind must be selective in what should be included and what can be omissible. Lakoff and Turner (1989, p. 55) indicated: "Poetic compression accounts in a part for the effort required to comprehend rich poetry even when all the metaphors in it are basic metaphors." Thus, here, they explain that the significance of rich poetry and metaphors depends mainly on the ability to decode compressed expressions. Fauconnier and Turner (2008, p. 54) explained that a crucial conclusion drawn from metaphor theory is that integration networks in metaphors "achieve

systematic compressions." Mar and Oatley (2008) pointed out that an important purpose of fiction is to offer models or simulations of the social world via abstraction, simplification, and compression. Accordingly, literary fiction is capable of presenting complex human relations and their outcomes in a compressed format. Thus, compression strengthens the ties of communication between the sender and the receiver and improves the quality of their intellectual exchange. Compressed artistic compositions are surprisingly notable.

Compression in the cognitive theory of conceptual blending

The concept of compression is tackled extensively by cognitive linguists within the frame of the theory of conceptual blending. Fauconnier and Turner (2002, p. 114) stated "Blending is a compression tool par excellence." Turner (2006, p. 100) confirmed that compression "is ubiquitous and indispensable throughout human understanding." Fauconnier (2008) explained that compression "allows certain goals to be realized in thinking and expressing ourselves … The overarching goal is to achieve human scale." Without compression, many things will be beyond the human scale of understanding. Thus, it brings diffused or dispersed data into a more accessible and legible form.

According to Fauconnier and Turner (2002, p. 92), the mechanism of compression of complex relationships achieves "global insight, human-scale understanding, and new meaning … One of the most important aspects of our efficiency, insight, and creativity is the *compression* achieved through blending." The theory of conceptual blending demonstrates that every blending scheme involves mapping between different mental workspaces and transferring data from both into a new workspace called the blend which is a creative amalgamation of both. Selective projections from different mental workspaces and integration in the blend provide an exceptionally strong process of compression (Fauconnier & Turner, 2006, p. 298). Therefore, Cook (2010, p. 31) indicated: "Compression is one of the governing principles of conceptual blending theory." Thus, the product of conceptual blending and its subsequent compression, the emergent blend, is characterized by novelty and originality which is one of the indexes of creativity as the emergent blend includes novel features which can be found in neither of the inputs.

For Fauconnier and Turner (2006), two phenomena occur in compression through blending, syncopation, and scaling. To syncopate is to leave out significant chunks in a vital temporal or spatial relations. Thus, it is the cutting down of subordinate relations between two entities. The second phenomenon is scaling which means cutting down duration or distance between the two input spaces. Fauconnier and Turner provided taxonomy of vital relations which show up repeatedly in compression under blending. They include Cause Effect, Time, Space, Identity, Change, and Uniqueness (2002, p. 93). "To have a human life, a human mind, and a system of constructing intelligible meanings is fundamentally a matter of continually compressing over such vital relations" (Fauconnier & Turner, 2006, p. 297). Dancygier and Sweetser (2014, p. 86) also indicated that one important process which characterizes every blend is the process of compression which "can work along various dimensions of the blend, including time, space, identity, analogy, disanalogy, causation, and role-value mappings." The integration of the vital relations of time and space leads to a structural compression, and this type of compression is very prevalent in literature in order to cover a wide temporal and spatial range within a limited narrative frame. "This template of compression allows us to understand a diffuse range of meanings that is spatially and temporally very far from the kind of thing human cognition is set up to recognize" (Turner, 2006, p. 106). Another type of relations is representation which "relates one entity or event with another entity or event that represents it" (Evans & Green, 2006, p. 421). Compression also works at the relations of change, comprising gradation and developmental stages, by scaling down the progress of change from one case to another. There is also compression of cause-and-effect relations. In a sequence of events or a narrative plot always lies a net of causes and effects, and compression works to minimize this net to the convenient scale of intelligibility.

In their early works, Fauconnier and Turner tackled compression as a process underlying blending. However, later both Fauconnier (2008) in "How Compression gives rise to metaphor and Metonymy" and Turner (2006) in "The Art of Compression"studied compression independently not as a subservient principle of blending but as a cognitive process crucial to the understanding and communication of data. Turner (2006, pp. 94–100) indicated: "The blend is a compression;" "whether we are at rest or in action, we face a chaos of perceptual data. Bombarded by this diversity, we perform the highly impressive mental trick of compressing great

ranges of it into manageable units." Thus, compression is not a mere underlying or subordinate process in conceptual integration but "in fact the ultimate goal of the whole blending process" (Ungerer & Schmid, 2006, p. 260). Turner (2014, p. 45) tackled blending as a tool of compression, explaining: "We create mental blends to help us manage diffuse mental webs that otherwise would be uncongenial to our thinking." Thus, he points out that the main goal of blending is "to help us compress ranges of information into something we can hold in mind" (p. 45). Fauconnier and Turner pointed out, "it is also essential for the culture to support decompression, so that the child can learn further skills and achieve greater overall flexibility. To learn to read and write, the child must not only blend but also deblend, not only compress but also decompress" (2002, p. 392). They stress the common dynamics between conceptual blending, compression, and decompression on the one hand and flexible thinking on the other. Since conceptual blending is a fundamental process in compression and decompression, the research experiment uses it as an index of flexible thinking.

Other aspects of literary compression in the light of other relevant theories

This part expands the boundaries of the process of compression and decompression by explaining it from the perspectives of other theories including conceptual metaphor, frame theory, symbolism, omission theory, and abstraction. They all emphasize the procreative power of literary compression in generating open-ended conclusions and divergent thinking, comprised in the process of decompression.

Compression and metaphorization

Metaphor is a pattern of conceptual association between a source domain and a target domain (the described quality or experience) from which selected elements are derived, associated, and integrated into a creative compressed image. Since the essence of metaphor for Lakoff and Johnson is "understanding and experiencing one kind of thing in terms of another", integration and compression are indispensable to its composition (1980, p. 5). Fauconnier and Turner (2008) developed Lakoff's theory of conceptual metaphor in the light of the theory of conceptual integration, stressing the role of conceptual blending in projecting data from the source to the target domain. They elaborate the role of integration and compression in the formation and apprehension of the conceptual metaphor. They explained that a crucial conclusion has been overlooked by both early metaphor theory and blending theory, indicating that integration networks in metaphor "achieve systematic compressions" (p. 54). They added that early metaphor theory "left out many of the powers of integration networks, in particular the ability to develop emergent structure based on preexisting conceptual structures and to achieve compressions across them" (p. 54).

Thus, metaphor is usually used for the purpose of compression. It is a means to an end not an end in itself. In everyday discourse, people tend to express their ideas metaphorically rather than literally because the former is more concise, impressive, and persuasive. For example, if we want to warn someone of wasting time, we can compress our advice into the metaphor, TIME IS MONEY. Thus, metaphorical compression facilitates the composition and recognition of meaning by reducing it to an accessible human scale. The essence of poetry is briefness and concision, so it expresses much in a few words and avoids redundancy. In "The Waste Land," Eliot (2005) compressed the disastrous state and ruin of the world after World War I into a telling image pregnant with intense significance; "you know only/ A heap of broken images" (p. 58). All visual sights of destruction in different places are summed up into this image.

Compression and symbolism

Both symbols and metaphors are conceptual forms of compression, but unlike metaphors, in symbols, the target domain is not made explicit but covert and ambiguous, so symbols are more concise. It is more complex because it conveys meaning in a subtler way depending on suggestion and under-telling rather than overt telling. Symbols offer a connotative source and omits the target. Since one part of the signifying equation is omitted, it encompasses less data and hence more compression. There are always no direct relations or similarity between a symbol and what it stands for. Thus, they intend to instigate the mind of the receiver to infer more than what the symbolic representation states. Tyson (2006) defined a symbol as "a sign in which the relationship between signifier and signified is neither natural nor necessary, but arbitrary, that is, decided upon by the conventions of a community" (p. 207). Thus, some traditional symbols have acquired fixed significance in preconception by the accumulation of cultural experiences. However, novel and creative symbols are undecidable and ambiguous, and their significance moves in diverged directions targeting various conclusions, so they evoke

a larger rate of information transfer. A symbol is a cognitive reconstruction of truth in which a concrete object can be decompressed and translated into a conceptual process equipped with wide-ranging chains of thoughts.

Compression and inferable omission

Hemingway's theory of Iceberg or Omission explains that compression and omission of superfluous data are at the core of literary creativity. In his interview with Plimpton, Hemingway (1958) stressed the connotative power of the unstated.

> If a writer of prose knows enough about what he is writing about, he may omit things that he knows and the reader, if the writer is writing truly enough, will have a feeling of those things as strongly as though the writer had stated them. The dignity of movement of an iceberg is due to only one-eighth of it being above water. (Hemingway, *Paris Review*)

Accordingly, data can be omitted because they are logically inferable. In *Out of Season*, he omitted the real end concerning the fate of the old man, indicating: "This was omitted on my new theory that you could omit anything if you knew that you omitted and the omitted part would strengthen the story and make people feel something more than they understood" (Hemingway, 1964, p. 75). Therefore, Hemingway's compression is dedicated to instigating divergent thinking and urging the reader to form his own original conclusion. Owing to omissions and narrative gaps, there is always more to tell, so even the finest crevices of the narrative progression are open to a world of further possibilities (Abbot, 2015). James (1955) explained in his notes for *The Portrait of a Lady* that "the *whole* of anything is never told" (p. 18). Abbot (2015) indicated that every narrative includes "shadow stories" which remain concealed for the sake of compression creating fillable gaps in narrative (p. 105). Thus, omitted details are complementary parts of the coherent whole, but they are left out for the sake of the artistic scale and the reduction of the author's authority over the text, opening an opportunity for the reader to make his own conclusions. Thus, omitted elements are not completely left out in compressed composition, but they are existent under the surface and intensely attributable to elements over the surface so that the reader can dig them out in the process of decompression.

The technique of omission is common in all literary genres, but it has a special presence in poetry because brevity and conciseness are the soul and tenet of this art. Pound's "In a Station of the Metro", consisting of fourteen words, is full of omission. Nadel (2007) indicated that Pound originally wrote a thirty-line Metro poem, but then he fashioned a poem half that length, a year later the poem was reformulated in its present form, two lines. The relation and conjunctions between the two lines are omitted, and each line seems to be incomplete because it lacks action verbs. Therefore, apparently the poem seems to be composed of fragments in an incomplete puzzle with no coherent meaning. The reader should infer the relation between the two lines, fill in gaps and draw conclusions; as such omission is compensated for, and compression is decompressed.

Compression and framing

This part discusses compression in the light of frame theory. Framing plays a crucial role in the processing of information and management of meaning and communication. Entman's definition of framing stresses salience and selection in this process:

> To frame is to *select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described. (1993, p. 52)

He also indicated that the power of framing "operates by selecting and highlighting some features of reality while omitting others" (p. 53). Frames "are manifested by the presence or absence of certain keywords … that provide thematically reinforcing clusters of facts or judgments" (p. 52). Frames are abstract constructs which organize data and structure the meaning of the message, deciding how information and significance are conveyed from writer to recipients, so the main goal of framing is to use language and data skillfully to focus the attention of recipients on certain events, prompting further divergent reactions and logical relations. Fairhurst and Sarr (1996) indicated that literature includes great examples of framing, regarding stories as linguistic forms of framing. Frames are used effectively in data compression because framing identifies certain boundaries for the expansion of the message or literary work which should not be transcended, creating compactness. Turner (Turner, 2006, p. 102) indicated that "frame is projected to the blend, giving a mirror network that, as always, compresses various disparate conceptual spaces into one unified blended space."

Fairhurst explained "framing reality means defining 'the situation here and now' in ways that connect with others" (2011, p. 3). Thus, a frame suggests information

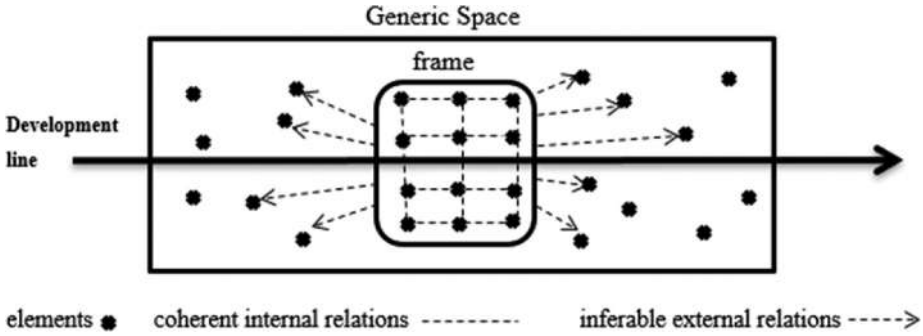

Figure 1. Compression through framing.

which transcends what lies within its boundaries. In narrative, the frame is placed on specific events to suit the artistic scale and achieve emphasis, concentration and economy. However, framed compression is capable of generating divergent thoughts, reactions, and conclusions because of its inherent associations with data and elements lying beyond the boundaries of the frame. Frames exert their power not only through what they highlight or include but also "through what they leave out" (Fairhurst & Sarr, 1996, p. 4). The frame compresses adjacent elements within its borderlines till it reaches its ultimate capacity leaving others outside the frame. The effective frame entails perceptible, coherent ties among its constituent elements (internal relations) and maintains subtle and implied relations with elements surrounding the frame (external relations) Figure 1.

The technique of framing was explained by Aristotle in his critical book, *Poetics* (1965). He explains that tragedy should focus on one single action even if it is about the life of one man. It cannot cover the whole life of a tragic hero, but it can focus on a certain significant episode in his life. As such, he sets a frame with clear boundaries within which all events should take place. His three unities – time, place, and action – are typical of this framing strategy. Sophocles' *Oedipus* is an example of this framing compression.

Compression and abstraction

Abstraction is a cognitive process by which a general concept is derived from concrete objects or signifiers. This concept acts as a central prototype or central example that represent and connects all subordinate concepts, elements and constituents of a specific-related category. Abstraction is a compression strategy as it entails selection of best representatives of a certain category, omitting inferable and observable elements and summing up relations.

Mar and Oatley (2008) indicated "Abstraction also means compression, greater portability, and ease of communication" (p. 177). Much like the way a single human case can summarize the preoccupations, traits, or flaws of a wider group of people or even mankind in general. Similarly, "fictional literature abstracts, summarizes, and compresses complex human relations by selecting only the most relevant elements" (p. 177). Literature as a form of abstraction can develop a character or a situation as an abstracted construct which functions to represent broader social or universal circumstances. Thus, abstraction conceptually relates variable pieces of underlying and integral data to a single projected item, character or signifier which can encompass or represent a wide-ranging entities and categories. Decompression processes the abstract concept by relating it to all associated and underlying constituents building a vast network of relevant ideas. "The abstract is the category which allows one to contemplate the infinite and perhaps to constitute it" (Galvan, 2010, p. 118). Thus, compression, constructed through abstraction, can stimulate divergent thinking in order to connect the abstract representation with its underlying and implied concrete reality.

The cognitive process of compression and decompression in mental workspaces

The matter of compression depends on understanding that data processing depends on mental workspaces and mapping between them. The mechanism of compression depends on moving from the maximum to the minimum. There are two major stages in the process of composition of creative compression; first, retrieval and collection of elements and components, second, reformulation and refining of data. In the process of composition, retrieval of information means that before devising a novel compressed composition, the mind has a predominant tendency to retrieve the features of the closest model or prototype preexisting in the mental category of the same domain. Turner (2014, p. 24) explained: "We carry with us compressed,

human-scale ideas – like the cyclic day. We bring them out when we need them, unpack them, and deploy them for help." Thus, from a cognitive point of view, preliminary knowledge is indispensable to the composition of a new compressed artwork. Boyd (2014, p. 21) stated: "Recent evidence shows that memory's compression into gist evolved not only to save space on our mental hard drives but also to make it easier to activate relevant memories and to recombine them with present perception or imagination of future." Researches in the neural basis of the mind and the role of the hippocampus offer an explanation of how this process functions. In the process of composition, data are retrieved from previous knowledge stored in the memory and connected with data gathered from the sensory receptors, and all are combined in one swarming workspace. Accordingly, the neocortex supplies the mind with incoming sensory information, and the subcortical region is responsible for the recollection of information from the memory. These data, gathered from variable workspaces, are assembled in the hippocampus which "acts as a cognitive mapping system" (O'Keefe & Nadel, 1978, p. 90). The hippocampus places them against each other and brings this integration to the consciousness which organizes material into an appropriate form. "The crucial effect of compression is that the conceptual complexity of the inputs from several sources is reduced considerably. A newly integrated and unified conceptual structure emerges that is cognitively manageable" (Ungerer & Schmid, 2006, p. 260). Thus, the process of gathering data leads to the emergence of the blend space which contains all amassed data. Then, the second major step works on polishing and reformulating the blend space in which ideas and data always emerge in a shabby and crowded preliminary form. The mental workspace begins as a container swarming with cluttered components, divergent ideas and complex networks which are manipulated to scale them down and reach the minimized version of the composition. Thus, gradually its volume is cut down by moving to a more minimized workspace which entails fewer elements or less mass, removing layers, omitting unnecessary data, and concealing inferable parts of the network Figure 2. "Data compression is the process of converting an input data stream (the source stream or the original raw data) into another data stream (the output, the bitstream, or the compressed stream) that has a smaller size" (Salomon & Motta, 2010, p. 2).

Figure 3 reveals how the shift to a more minimized mental workspace also requires the reduction and squeeze of relations between elements to fit in the compressed workspace of the output. These relations can be causal, developmental, or consequential.

Thus, compression treats not only elements and data but also the in-between relations. This process is always gradual because it goes through gradations working on a layer by layer. It is like peeling a fruit removing a crust after another till the mind reaches the kernel. When such a file is ultimately compressed, there is no redundancy or superfluity to remove. If it were possible to compress an already compressed file, then successive compressions would reduce the size of the file until it reaches the minimal form which cannot be reduced farther (Salomon & Motta, 2010, p. 7). Thus, the communicative message is treated as a floppy disk or a memory storage device which works more efficiently when its data are more compressed.

Both compression and decompression are two faces of the same cognitive process. While the mechanism of compression is useful for writers in the stage of encoding composition, decompression

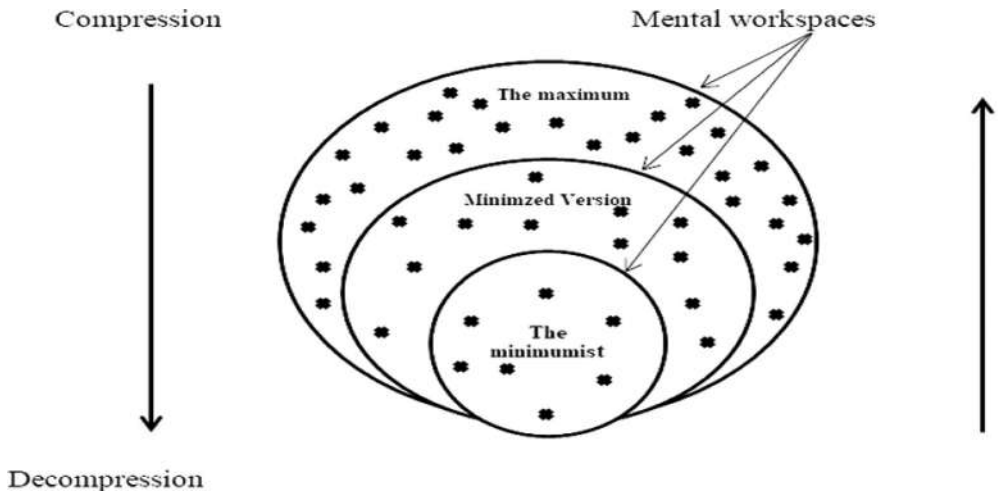

Figure 2. Graded minimization in compression of mental workspaces.

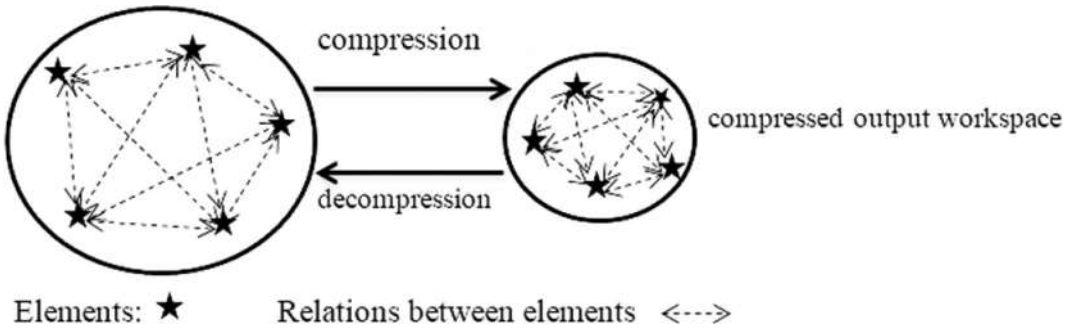

Figure 3. The squeeze of conceptual relations between elements of compressed workspaces.

enables the reader to decode the ambiguity of the writer's work and infer the underlying significance. Thus, decompression is the opposite operation related to the recipient's comprehension of the compressed message. In a compressed network, only some segments are available not all, so decompression is needed to decode the compressed form, explore logical relationships between existent, self-evident basic elements and relate them to secondary implicit elements, constructing a whole network of connections and generating infinite divergent thinking. Consequently, the buried or insinuated parts are dug out. One step leads to the subsequent one till the mind suggests completions, establishes a whole system, calculates outcomes, and draws a comprehensive conclusion. Thus, decompression transforms compression to an elaborate composition, starting from the focal point and moving into divergent rays which proceed and progress from it into more complex networks. It is like the center of sound source from which larger and larger waves issue and disseminate. Thus, the output of decompression may include data and conclusions which may outweigh and transcend the input of compression, and here lies the creative potentials of artistic compressed works (see Figure 4). Turner (2014, p. 9) indicated "We use compressed, tight, tractable blends to help us think about larger mental webs."

Text and entropy density

Compression means not only simple brevity but also concentration of high ideational density into a sparse space or medium. Information transfer from the sender to the recipient depends on the concept of text density which is related to the number of words in a text in relation to the amount of meaningful data it can transmit. Compression makes the text denser by squeezing more data into a briefer linguistic medium. Abbot (2015, p. 105) called the omitted or implicit elements in a compressed composition "shadow stories" which remain concealed for the sake of conciseness, creating fillable gaps in narrative. Thus, in the compressed text the density of data transmission depends on comprehending both the explicit and the implicit or the main text and subtext. The entropy, the rate of data transfer in a particular message, "is distinguished not only by what is said but also by what is suggested in what is unsaid" (Goodheart, 2010, p. 4). Thus, omitted elements are not completely left out in a compressed composition, but they are existent and active under the surface in the subtext and intensely attributable to explicit elements over the surface. Moreover, a text of brief linguistic medium and high entropy density is always more attention-grabbing, challenging, aesthetic and memorable, so it instigates the reader to manipulate it from multidimensional aspects in order to

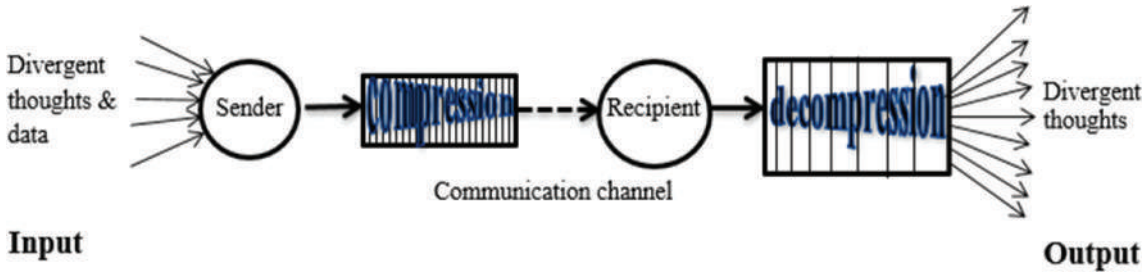

Figure 4. Compression and decompression of a communicative message.

Table 1. Summary of differences between the compressed and descriptive texts.

Compressed text	Descriptive text
Fewer words	More words
Higher information density	Lower information density
Implicit significance	Explicit significance
Omitted inner connections	Present inner connections
Memorable	Unmemorable
Stimulating higher cognitive activity	Stimulating less cognitive activity

decompress its matrix into a more elaborate network of significances and relations.Table 1

Accordingly, compression involves and urges the reader to fill in gaps and think beyond surface meaning, so compressed texts have a more powerful cognitive impact than direct, plain, detailed texts which convey only what is directly mentioned. Despite their ambiguity and complexity, compressed texts represent food for thought. Thus, divergent thinking plays a crucial role in the process of decompression.

Experiment

Design and purpose of the study

The research experiment focuses on the utilization of compression theory into the literary experience in order to discover its creative potentials and effect on divergent thinking using an experimental method. The concrete body of research on the effects of comprehension, interpretation, and evaluation of literature has grown over the years and there is now a considerable and expanding field of empirical and experimental studies of literature (Zyngier, Bortolussi, Chesnokova, & Auracher, 2008). In this emerging field, researchers aim at observing the effect of literature on readers objectively rather than predicting it without empirical evidence (van Peer, Hakemulder, & Zyngier, 2007). Therefore, today more humanities and literature departments adopt methods of empirical research. Hakemulder (2000) argued that empirical research methods are appropriate for measuring the effects of reading literary texts. The cognitive study of literature and its effect on promoting cognitive capacities, depending on empirical studies, interprets why literature still matters in the contemporary time (Karam & Elfiel, 2020). Thus, the empirical study of literature enables scholars to explore the potentials of literature and their influence on specific cognitive capacities revealing how literary reading contributes to making us what we become, shaping our emotions and concepts of self (Miall, 2019).

The purpose of this study is to determine if variations in textual compression level has an impact on participants' divergent thinking, creative writing, and novelty of interpretation. This study elicited participants' responses to the reading of compressed and descriptive texts in order to examine their different impacts on their outputs of divergent thinking and on their ability to introduce original ideas in written works. The experiment used the between-groups design, control group, and experimental group. In the pretest, the participants of the two groups were asked to read the same informative, descriptive passage about railroad capacity. In the posttest, the independent variable of tackling a creatively compressed passage was administered to the experimental group, while the control group read another descriptive passage. The experiment examined the different effects of reading the two passages, the descriptive and the compressed, using two measures, conceptual and linguistic. It attempted to illustrate the correlation between tackling compressed literary texts and the increase in participants' creative thinking, translated into their written critical analysis and conceptual outcome.

Hypotheses

Based on theoretical positions presented above, four hypotheses were formulated:

Hypothesis 1. Fluency: It was expected that improvement in fluency of participants or productivity of inferred ideas should be higher for those who tackled the compressed text than for those who read a plain descriptive text in the control group. The subtlety, ambiguity and lack of a clear-cut meaning of the compressed text would instigate the participants of the experimental group to search for underlying meanings on various levels and construct divergent, potential significances.

Hypothesis 2. It was expected that improvement in originality of participants' inferred ideas should be higher for those who tackled the compressed text than for those who read a plain descriptive text in the control group. This would imply the impact of tackling compressed texts on generating unique, original ideas.

Hypothesis 3. flexibility: Significant differences would be found in the participants' ability to discover connections between the variable categorical ideas suggested by the two texts in favor of the experimental group.

Hypothesis 4. Written output: The difference in conceptual and divergent thinking would be translated in the produced linguistic outputs of participants in the two groups. It was expected that improvement in participants' linguistic proficiency should be higher for

those who tackled the compressed text than for those who read a plain descriptive text. The written output of the experimental group would achieve higher scores in the assigned linguistic indices demonstrating more elaborate, fluent, meaningful and original writing.

Method

The experiment used the between-groups design which involved the testing of one factor in each group, the reading of a descriptive text in the control group, and the reading of a compressed text in the experimental group. This study aimed at eliciting the participants' responses in these two experimental conditions.

Participants

The sample was (n = 125) university students in the fourth year at Suez University, majoring in English Language and Literature. The average age is 21 years old. Ninety-two were female, and 33 were male. Careful examination of the data suggested that 21 participants should be excluded from analyses for various reasons; their responses were incomplete, or they suggested ideas, but they failed to justify them in the writing section of the test. Since they could not explain their ideas and relate them to the text, these ideas were deficient in appropriateness. Runco, Illies, and Eisenman (2005) indicate that ideas, the product of divergent thinking, cannot be considered original unless they appropriately fit the context. This resulted in 104 participants in the final analysis. They were randomly assigned to the two groups, the control and experimental groups, making sure that none of the participants had read the two passages of the experiment before.

Then, they were instructed to write a paragraph to explain and justify each idea they inferred in the divergent thinking tasks.

Materials

The passage that was chosen for the control group is an extract from Wilkie Collins's *No Name* (1986, p. 134): "That entire incapability of devising administrative measures for the management of large crowds, which is one of the characteristics of Englishmen in authority, is nowhere more strikingly exemplified than at York … A sudden parting of the crowd, near the second-class carriages, attracted the captain's curiosity." The descriptive passage contains 133 words in ten lines, divided in two parts; one refers to the incompetence of railroads management and officials, and the other describes the consequent crowdedness and chaos. It is plain, explicit, and detailed. The connection between the two parts is a clear relation of cause and effect. The passage that I chose for the experimental group is Ezra Pound's poem, "In a Station of the Metro," known for its outstanding compression.

> The apparition of these faces in the crowd:
>
> Petals on a wet, black bough. (Pound, 1957, p. 35)

The poem is composed of fourteen words divided in two lines. In this poem, compression is unprecedented; "no English poem had been expected to carry so much meaning in so few words … the poem allows for an extremely open-ended set of possible meanings" (Beach, 2003, p. 27). The connection between "faces in the crowd" in the first line and "petals on a wet, black bough" in the second line is ambiguous and subtle as conceptual relations are omitted for the sake of compression and suggestion of open-ended and infinite conclusions.

The apparent significance of both texts rotates around a scene of passengers in a crowded, modern transportation station. However, because of its creative compression, Pound's poem is open to multilayered interpretations, prompting the reader's mind to search for divergent thoughts. Therefore, it was used as a research material to examine the impact of tackling compressed works on divergent thinking and creative skills. Pound (1970) indicates how reading poetry can instigate never-ending divergent thinking by expanding his definition of the compressed poetic image: "a radiant node or cluster, it is what I can, and must perforce call a VORTEX, from which, and through which, and into which ideas are constantly rushing" (p. 92). Therefore, critics agree that Pound's creativity lies in his extreme compression of utterance, the force and weight of large forms rendered in the space of very few words, thus offering broad potentials to generate divergent thinking (Ingham, 1999). His condensation makes him cryptic, and the excision of rhetoric represents a challenge to the readers of his poetry (Nadel, 2007). Pound's ideogrammic method of shaping poetry uses a calligraphic and pictorial representation capable of expressing a multitude of ideas in a very compressed, economical manner (Kenner, 1985; Schwartz, 1985).

Measures

The present study used two measures in order to investigate the different impacts of the two variables, reading a creative, compressed text and reading a direct, descriptive passage. The first measure is conceptual; it evaluates the students' level in creative

thinking skills and divergent thinking in terms of fluency, originality, and flexibility. Fluency "is defined in terms of productivity. A fluent individual gives a large number of ideas" (Runco & Acar, 2012, p. 67). Originality is operationalized as the statistical infrequency and uniqueness of responses to a certain stimulus, the unusualness of respondent's ideas (Runco & Acar, 2012). This study adds the capacity of conceptual blending to the criteria of measuring creative potentials as an index of flexible thinking. "Flexibility leads to diverse ideas that use a variety of conceptual categories" (p. 67). It is also the number of connections among different areas, categories, and ideas (Turkman & Runco, 2019). Therefore, the cognitive capacity of conceptual blending is a fundamental aspect of flexible thinking because it mainly works on mapping data from various mental workspaces. Several cognitivists indicated that the capacity to conceptually blend categories, cross categorical boundaries, and create mapping between them demonstrates flexible creative thinking (Karam, 2018; Spolsky, 2010; Turner, 2014; Turner & Fauconnier, 1999). "The effect of blending and deblending, compressing and decompressing, is to create much richer networks, with the greater flexibility" (Fauconnier & Turner, 2002, p. 392). Turner (2014) pointed out that the hallmark of modern human cognition is the general, flexible ability to blend concepts which belong to different categories. "Advanced blending provides us with extraordinary flexibility and a unique power for innovation" (Turner, 2014, p. 198). Spiro and Jehng (1990) pointed out this integrative attribute of cognitive flexibility, defining it as "the ability to adaptively re-assemble diverse elements of knowledge to fit the particular needs of a given understanding" (p. 169).

The second measure is linguistically oriented; it assessed the participants' written responses to the verbal prompts, the descriptive and the compressed. Previous studies showed that "creativity has its own unique way to show itself in written documents" (Turkman & Runco, 2019, p. 19). Thus, this measurement examined the impact of the two different reading texts on prompting the participants' creative writing. This study adds eight linguistic indices to the index of idea density used by Runco, Turkman, Acar, and Nural (2017) for quantifying the ideation and creativity of high-level performances in written texts. They include word count, sentence length, language sophistication, lexical variation, lexical density, written frequency of content words, imageability, and meaningfulness. These indices of linguistic proficiency or complexity are utilized in an extensive body of research as indicators of the quality of learners' overall writing and development in language production (Juanggo, 2018; Kyle, Crossley, & Berger, 2018; Palfreyman & Karaki, 2019). These indices are compatible with the studies of creative potentials because they can measure originality by determining the level of frequency and effectiveness. They can also measure flexibility by showing to what extent diverse words are used and connected. They can also measure fluency by calculating the quantity of lexical density and idea density and evaluate elaboration as demonstrated in word count and sentence length.

Word count, sentence length, and idea density are specified for assessing quantity, while the rest of indices are used to measure quality. Elaboration, which refers to the ability to extend ideas into the written responses to the given stimuli, is scored by measuring the word count and sentence length in each response. Dascalu (2014) indicated that the most computationally feasible measures of textual complexity "are covered by quantitative factors, such as word frequency and sentence length" (p. 16). Word frequency indices, referring to the use of less common words, are predictive of holistic quality and proficiency scores with written outputs that include lower frequency words tending to earn higher quality and proficiency scores (Crossley, Cobb, & McNamara, 2013; Kyle, Crossley, Berger, 2018). Word frequency has also been used as a measure of lexical richness which additionally includes lexical variation, lexical sophistication, and lexical density (Jarvis, 2012). Lexical sophistication (LS) deals with the proportion of advanced vocabulary employed by learners in their writings (Juanggo, 2018; Palfreyman & Karaki, 2019). Lexical density (LD) is estimated by computing the ratio of lexical items, content words, to the total number of words. Halliday (2004) pointed out that language bears more weight of meaning and "becomes complex by being lexically dense" (p. 354). The index of *imageability* measures the degree of complexity of imagination about a word revealing how easy it is to create an image of a word (Ravi & Ravi, 2017). The index of meaningfulness measures the ease of conceptually integrating words with one another.

Word frequency measures calculate how frequently a word occurs in general usage, as measured by a representative corpus such as the British National Corpus which assigns an average rating to the whole text and indicates its lexical sophistication (Kyle, Crossley, Berger, 2018). This experiment uses the British National Corpus (BNC) which comprises 100 million words of written and spoken English from Great Britain in order to provide separate scores for the

level of written frequency. Accordingly, a more sophisticated and richer text is one with more low-frequency words according to BNC.

Procedures

A pretest was conducted using the same procedures of the posttest but with a different reading material. In the pretest, the participants of the two groups were asked to read the same text, a descriptive, informative passage about railroad capacity extracted from *Station Capacity Assessment Guidance* of the British public company, Network Rail. There were no significant differences between the means of the two groups in the pretest in the two measurements of linguistic outputs and creative thinking skills. This ensured the equivalence between the two groups.

In order to examine the potentials of tackling creative compression, a compressed text was put into experimental contrast with a plain, direct descriptive text in the posttest. Divergent thinking tasks were administered with the demographic information form. The divergent thinking tasks used in this study consisted of two items, one for the ideas inferred from the reading texts and the other for drawing connections between different ideas and components in each text. In creative writing tasks, the students were asked to write a paragraph about their inferred ideas to justify them.

Participants were given the following instructions:

- In thirty minutes, read the text and then do the following tasks:
- Identify the genre of the text and its stylistic and textual features.
- Discover the idea or ideas of the text and put them in the theme list.
- In the control group, draw as many connections as you can between the two paragraphs of the text and state them in the connection list.
- In the experimental group, draw as many connections as you can between the two lines of the text and state them in the connection list.
- Then, they were instructed to write a paragraph to explain and justify each idea they inferred in the divergent thinking tasks. They were given 15 minutes to finish the paragraphsTable 2.

The participants' outputs were analyzed for conceptual content and divergent thinking, counting the numbers of ideas and connections each participant inferred in the two experimental groups to determine fluency. The inferred ideas in each condition were classified according to the number of frequency or occurrences in order to measure the degree of originality. Then, the quality score was determined by giving 4 points to ideas given by less than 2% of the population, 3 points for those produced by 3–6%, 2 for 7–10%, and 1 for 10–18%, and 0 for the remainder. Extremely bizarre responses to divergent thinking test which participants failed to justify and relate to the text in their written output were excluded. The participants were asked to identify the genre of each text in order to draw their attention to the distinctive stylistic features of the two texts, the compressed and the descriptive. It is noteworthy that each of the two texts of the experimental material poses a problem. Asking the participants to draw connection between the thematic components of each text and integrate them conceptually into statements is used to assess to what extent each text stimulates the participants' flexible thinking and problem discovery.

Then, in order to evaluate the participants' creative writing, their written outputs were analyzed with three software utilities. First, Lexical Complexity Analyzer (Lu, 2012) measures various dimensions of lexical richness, such as lexical density, sophistication, and word variation using 25 different indices. Second, Tool for the Automatic Analysis of Lexical Sophistication (TAALES) is a tool that measures over 400 classic and new indices of lexical sophistication (Kyle et al., 2018). Last, Computerized Propositional Idea Density Rater (CPIDR 5) is a computer program that determines the propositional idea density (ID) of a written text.

Results

The results supported all hypotheses and demonstrated the following processing differences between the control group and the experimental group.

Hypotheses one, two, and three postulated that the scores of participants in the experimental group will be higher in fluency, originality, and flexibility. The results supported these hypotheses. There was a significant

Table 2. Significant differences between the average degrees of two groups in the posttest of creative thinking skills (n = 104).

Variables	Group (1) Descriptive		Group (2) Compressed		Significant differences		Effect Size (η2)	
	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.	Value	Sig.
Fluency.	1.52	0.54	2.85	0.70	10.84	0.000	0.535	large
Flexibility.	1.15	0.36	3.42	0.94	16.29	0.000	0.722	large
Originality.	1.63	1.21	5.87	2.79	10.05	0.000	0.497	Medium
Total	4.31	1.52	12.13	3.50	14.81	0.000	0.682	large

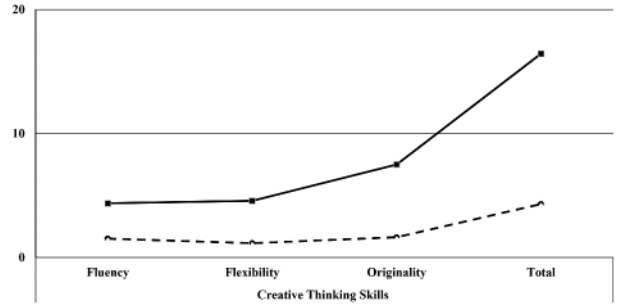

Figure 5. The bar charts for the mean scores of the two groups in posttest of creative thinking skills.

difference in the scores of fluency for the experimental group reading the compressed text (M = 2.85, SD = 0.70) and control group reading descriptive text (M = 1.52, SD = 0.54); t = 10.84, p = .000. Concerning the originality of the participants' ideas, students of the compressed group reported higher originality (M = 5.87, SD = 2.79) than did the participants reading a descriptive text (M = 1.63, SD = 1.21), indicating a significant difference, t = 10.05, p = .000. Concerning flexibility, the result of participants' ability to draw conceptual integration between the different conceptual categories inherent in the two texts indicated a significant difference in the scores for experimental group of compressed text (M = 5.87, SD = 2.79) and control group of descriptive text (M = 1.15, SD = 0.36); t = 16.29, p = .000.(Figure 5) Table 3

Concerning the linguistic measure indicated in the fourth hypothesis, there was a significant difference in the scores of word count for the compressed (M = 143.42, SD = 47.16) and descriptive (M = 67.98, SD = 17.94) conditions; t = 10.781, p = .000. Participants tackling the compressed text reported writing more prolonged sentences (M = 16.27, SD = 3.47) than did the participants reading the descriptive text (M = 12.35, SD = 2.33), t = 6.77, p = .000. The participants' outputs in the compressed condition included higher lexical density (M = 0.51, SD = 0.03) than did the participant's outputs in condition of reading the descriptive text (M = 0.48, SD = 0.04), t = 3.67, p = .000. Results indicated

Table 3. Significant differences between the average degrees of two groups in the posttest of the linguistic measurement (n = 104).

	Group (1) Descriptive		Group (2) Compressed		Significant differences		Effect Size (η2)	
Variables	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.	Value	Sig.
	67.98	17.94	143.42	47.16	10.781	.000	0.533	High
Sentence Length	12.35	2.33	16.27	3.47	6.767	.000	0.310	Medium
Lexical Density	0.48	0.04	0.51	0.03	3.614	.000	0.114	Small
Lexical Sophistication	0.14	0.05	0.26	0.05	12.318	.000	0.598	High
Lexical Variation	45.38	8.73	84.35	20.51	12.605	.000	0.609	High
BNC Written Frequency	1.08	0.35	0.90	0.22	3.169	.002	0.090	Small
Imageability	389.64	15.82	412.96	17.32	7.170	.000	0.335	Medium
Meaningfulness	340.80	14.67	353.54	12.28	4.801	.000	0.184	Small
Idea Density	0.46	0.04	0.50	0.04	5.672	.000	0.240	Small
Total	858.31	30.21	1012.70	73.36	14.033	.000	0.659	High

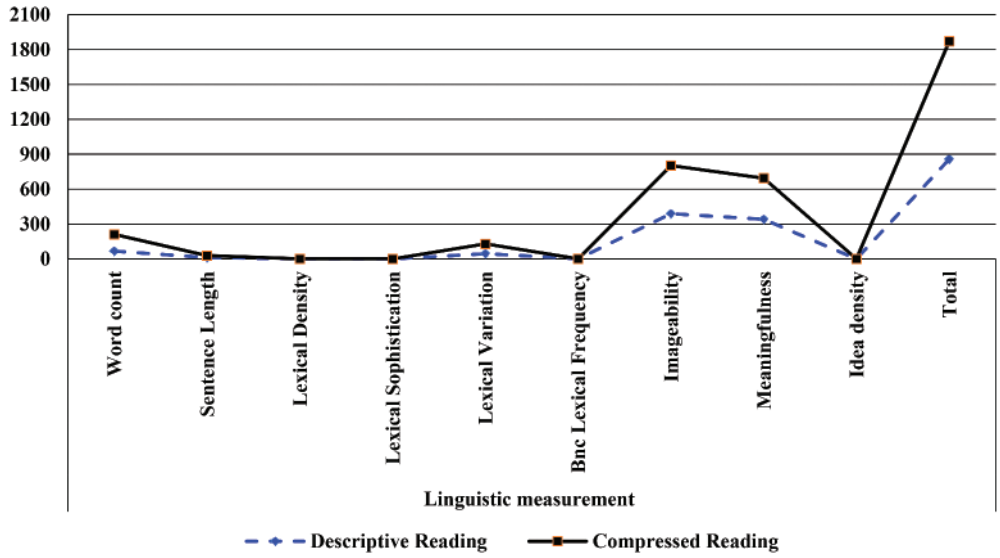

Figure 6. The bar charts for the mean scores of the two groups in posttest of linguistic measurement.

that the average number of scores of lexical sophistication was significantly higher in the experimental condition of compressed text (M = 0.26, SD = 0.05) than was that in the control group of descriptive text ($M = 0.14$, $SD = 0.05$), $t = 12.318$ $p = .000$. The participants' outputs in the compressed condition included higher lexical variation (M = 84.35, SD = 20.51) than did the participant's outputs in the condition of the descriptive text (M = 45.38, SD = 8.73), $t = 12.60$, $p = .000$. Results indicated that the mean number of scores of written frequency was significantly lower in the experimental condition (M = 0.90, SD = 0.22) than was that in the control group ($M = 1.08$, $SD = 0.05$), $t = 3.17$ $p = .002$. Results indicated that the mean number of scores of imageability was significantly higher in the experimental condition (M = 412.96, SD = 17.32) than was that in the control group ($M = 389.64$, $SD = 15.82$), $t = 7.17$ $p = .000$. The participants' outputs in the compressed condition included higher meaningfulness (M = 353.54, SD = 12.28) than did the participant's outputs in the condition of the descriptive text (M = 340.80, SD = 14.67), $t = 4.80$, $p = .000$. Concerning idea density, there was a significant difference in the scores of idea density for the experimental group reading the compressed text (M = 0.50, SD = 0.04) and the control group reading the descriptive text (M = 0.46, SD = 0.04); t = 5.67, $p = .000$. Thus, the result was significant at $p < .05$.(Figure 6)

Discussion

This study demonstrated the correlation between the tackling of compressed literary works and the promotion of divergent thinking and creative writing. This distinctive advantage of compression was highlighted by comparing it with a plain, detailed, descriptive text.

The research experiment depended on divergent thinking (DT) tests as "reliable estimates of creative potential. They do provide reliable scores about ideation, including the originality, flexibility, and fluency of ideas" (Dumas & Runco, 2018, p. 466). The statistical calculations showed that the scores of participants reading a plain descriptive text were significantly lower in fluency, originality, and flexibility than the scores of participants tackling a compressed text. Thus, the control group inferred fewer ideas which are more frequent and less unique. It is noteworthy that the participants' ideas in the control group are the product of either perceptual cognition, such as "crowdedness," "chaos" and "capacity of railroad stations" or comprehension process of explicit significance, such as "mismanagement of railroads" and "problems of railroads." Most of them see the descriptive passage in terms of spatial and sensory construction, perceiving entities in space and movement, like the crowd of passengers and the station. Therefore, their thinking is concentrated within a limited scope. The plain, descriptive text restrains the participants' creative thinking and inference because they realize that its significance is explicit; therefore, their analysis of this text needs no further cognitive activity or deeper exploration.

The statistical calculations showed that the participants' ideational productivity, originality, and flexible thinking were considerably greater in the experimental group, proving that the analysis of a creatively compressed text spurred the mind of participants to engage into more wide-ranging, divergent thinking in their process of decompression. Thus, the ideas inferred in the compressed experimental condition were greater in quantity and quality. In the experimental group, the inference of ideas is 46.73% more than the control group. In their decompression of the compressed text, participants inferred 148 ideas (M = 2.85); 20.27% of them are mentioned once. Since a significant requirement for the quality of creative writing is the construction of original interpretations of experience indicating a meaningful understanding (Runco, 2019; Runco & Jaeger, 2012), the infrequency and uniqueness of participants' ideas illustrate the development of creative potentials in the experimental group tackling compressed text. Originality is a part of a universal capacity to construct meaningful *interpretations of experience*, but "originality is not alone sufficient for creativity as original things must be characterized by effectiveness which may take the form of usefulness, fit, or appropriateness" (Runco & Jaeger, 2012; Runco, 2016, p. 102). Therefore, original ideas which participants only managed to justify in interpretation and relate to the reading text, the experimental material, are counted. The higher scores of divergent thinking in the experimental group involved higher production of ideas derived from the given information of the verbal stimulus, the compressed text, which enabled them to give free rein to their interpretive thinking and creative analysis. Thus, they read between the lines, and the practice of decompression gave them more to do mentally, achieving greater cognitive engagement.

The higher fluency, flexibility, and originality signal a wider stimulation of mental workspaces underlying the participants' cognitive activity. The compressed text stimulates variable mental workspaces because of its ambiguity, multilayered significance, and subtlety. The wide variety and uniqueness of ideas show that the compressed text appeals to participants in diverse ways. Taking a sample of participant's inferred ideas for analysis, a small slice of participants received the

text in perceptual terms focusing on the spatial and concrete aspect of Ezra Pound's poem describing the station of a metro. Therefore, they concluded that the poem focuses on the sensory image of a crowded place. Some participants read the passage through a process of motor perception, so they suggest that the passage is bout "mobility and change of masses." The ideas inferred by some participants are the result of the cognitive process of embodied simulation with the text they read. The process of simulation refers to the notion that readers "construct mental experience of what it would be like to perceive or interact with objects and events that are described in language" (Bergen, 2016, p. 142). They indicate that the compressed text makes them experience a sense of entrapment or exhaustion. However, the vast majority of ideas are the product of deeper conceptual processes. Some participants translate the concrete description of the text into abstract concepts depending on the activation of the capacity of cognitive abstraction and conceptualization. "Abstraction is the way of thinking that depends on human capacity to recognize the real world under different levels," so it is crucial for the decompression of the multilayered significance of compressed texts (Shivhare & Kumar, 2016, p. 243). They conclude that the poem focuses on abstract ideas such as "human vulnerability" and "conformity and lack of individuality." Some inferred ideas are the product of the cognitive process of empathy as some participants feel the presence of a human voice behind the lines, expressing his subjective experience in a covert manner, and consequently, they attempt to empathize with him. They suggest that the text illustrates"someone's sense of loneliness among the crowd" or "isolation and absence of communication." The examination of another sample of themes can identify other cognitive processes beyond participants' ideational production. There are variable ideas which arise from both inductive and deductive inference. For example, some participants inductively draw a universal or general conclusion from specific details. They relate the fleeting movement of passengers to the fallible petals and infer the general concept of life journey or transience. Other participants deductively draw a specific logical conclusion from general premises arguing that the poem is about "the difficulty of contemporary life" or "the quick rhythm of life in contemporary societies" as experienced by the poet in his context. Some ideas arise from the cognitive process of imagination which enables participants to abstractly see visual images without any relevant sensory input. Therefore, some suggested ideas encompass no direct relation to the text. For example, one participant suggests that the poem is about enslavement of people who are compared to petals tied to a black branch. According to this unique interpretation, modern people are confined into a suffocating course of action and lifestyle, acting like slaves. This wide variety of categories and themes used by the participant in the experimental group reflect higher flexibility which is stimulated by the ambiguous and multilayered nature of the compressed text.

In the experimental group, the participants' scores in suggesting connections between the two lines of the compressed text reflects a higher ability to cross borders between different categories and find relation between the two irrelevant entities or components of the poem, humans and vegetation. This reflects a higher degree of flexibility which is the ability to draw connections among areas and ideas (Runco et al., 2017; Turkman & Runco, 2019). Compression and its consequent omission of relations and details make this poem and any artwork in general appear as a puzzle or a problem that challenges the participants' minds. It does not state how the passengers' faces in the metro are related to the petals on a black bough, leaving this matter open to the reader to guess conceptual connection. Therefore, the number of connections which the participants can discover can serve as an index showing to what extent the text can stimulate their capacities of problem discovery and conceptual integration. In the descriptive text, the writer also highlights a problem whose recognition is based on drawing connection between the incompetence of railroad management and the consequent chaos prevalent in the described station. However, this problem is explicitly stated because of the descriptive and plain nature of the text. Therefore, the significant difference in scores of discovering connection indicates the difference between the effect of the two verbal stimuli, the descriptive and the compressed. The latter revealed a higher generative power in the indexes of divergent thinking.

The results showed that in the experimental group participants' level of creative writing improved in response to reading the compressed text. Thus, their higher scores in creative thinking skills were translated into their written output. Their scores revealed higher elaboration, fluency, flexibility, and originality which were manifested in the assigned linguistic indices, word count, sentence length, language sophistication, lexical variation, lexical density, BNC written frequency of content words, imageability, meaningfulness, and idea density. The written output of participants in response to the compressed text included less frequent words according to BNC

corpus. Accordingly, their written outputs feature higher originality. The higher lexical density in their writing reflects a higher degree of concentration of information and communication of meaning (Halliday, 2004; Read, 2000). The significant difference in the imageability variable in favor of the experimental group indicates that in response to their treatment of the compressed literary work, participants used more words which evoke mental images demonstrating a higher degree of complexity of imagination (Ravi & Ravi; 2017). Thus, these linguistic variables emphasize the effectiveness and quality of their original written production. Moreover, their written outputs are higher in lexical sophistication (LS) using more unusual or advanced words and more developed in lexical variation (LV), indicating a bigger number of different words from variable categories in each participant's output. The higher scores in the index of meaningfulness reflect the higher ability of the experimental group in connecting different words. These three indices, LS, LV, and meaningfulness, are regarded as significant indicators of flexibility, a component of divergent think.

In the experimental group, the participants' higher scores in word count and idea density indicated a significant development in fluency. Runco et al. (2017) pointed out that fluency scores are derived from the ideational output and have shown to be predictive of creative activity and achievement. Moreover, fluency in writing refers to the ability to provide products that are sufficiently long and elaborated for the topic, so an important measure here is the number of words written (Paul & Norbury, 2012). Moreover, the increase in sentence length and word count in the experimental group reflects deeper elaboration as subjects expatiate freely on what they guess to be a decompressed and decoded interpretation of the compressed text. Dascalu (2014) also emphasized that "a piece of information should be more valuable if transmitted in multiple messages, linked together, and expressed in more words, not only to impress others but also to be meaningful in the given context" (p. 96). It is noteworthy that these linguistic indices are interrelated and interdependent as the accumulation of their measurement can reflect the overall value and richness of the written output. Linguistic richness and intricacy of meaning have been recognized as an important measure in first and second language research as it is directly related to the learner's ability to communicate effectively in both spoken and written form (Lu, 2012). Linguistic richness, indicative of writing quality, is determined by a taxonomy of the aforementioned indices, including written frequency, lexical Variation, lexical sophistication, and lexical density, which are used to assess students' overall progress. (Gregori-Signes & Clavel-Arroitia, 2015; Jarvis, 2012; Kyle et al., 2018). Laufer and Nation (1995) found that there is a positive correlation between the quality of writing produced by second language learners and these lexical features. Thus, results indicate the correlation between tackling or contemplating inspiring compressed artworks as a cognitive stimulus and spurring creative writing equipped with a richer linguistic content and proficiency.

The primary limitation of this study is that it examined only two literary texts, the compressed and the descriptive, belonging to two literary genres. A more comprehensive and comparative study is needed to investigate the variable impacts of other literary genres on the stimulation of divergent thinking and creative writing, using a collection of different texts.

Conclusion

Compression is a communicative means and a major tool of literary creativity, so its potentials and mechanism need to be studied further. The experiment, conducted in this paper, demonstrates that the deliberate cognitive process of decompression of compressed literary texts develops both the creative and analytical skills which readers need to deepen their critical thinking. These skills include inference of ideas, flexible thinking, drawing original conclusions, and elaboration of ideas. Creative compression also instigates participants to translate their conceptual reaction into a more creative written output. This research recommends a further study of the capacity of compression and decompression within the scope of creativity studies as a cognitive process underlying creative performance and an index of creative potentials.

The contrast drawn between the compressed and the descriptive does not aim at undermining the value of descriptive passages but attempts to raise the value of reading compressed texts on the cognitive level. Readers construct understandings from the compressed and the descriptive differently because texts themselves appeal differently to the mind of the reader. When tackled deliberately, the compressed text proves to be more instigative for critical analysis and creative potentials than the plain, descriptive text. Literature is a creative linguistic medium employed to communicate ideas, and its significance depends on the density and diversity of the ideas it generates in the mind of the recipient. Literary compression is efficient in this concern as it instigates the students to draw diverse conclusions, interpret creatively, and write profusely. Therefore, understanding the methods of compression discussed in this study guarantee better understanding of how a literary work can be compressed and decompressed.

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References

Abbot, P. (2015). How do we read what isn't there to be read? In L. Zunshine (Ed.), *The Oxford handbook of cognitive literary studies* (pp. 105–119). USA: Oxford University Press.

Aristotle. (1965). *Classical literary criticism*. Trans. T. S. Dorsch. Great Britain. Middlesex, England: Penguin Books.

Beach, C. (2003). *The Cambridge introduction to twentieth-century American poetry*. USA: Cambridge University Press.

Bergen, B. (2016). Embodiment, simulation and meaning. In N. Riemer (Ed.), *The Routledge handbook of semantics* (pp. 142–157). New York, NY: Routledge.

Boyd, B. (2014). Psychology and literature: Mindful close reading. In C. Danta & H. Groth (Eds.), *Mindful aesthetics* (pp. 17–28). New York, NY: Bloomsbury.

Carter, T. (2003). Shannon, claude. In L. Nadel (Ed.), *Encyclopedia of cognitive science: Vol. 4*. (pp. 1–4). New Jersey, USA: Wiley.

Chaitin, G. (2010). Leibniz, complexity and incompleteness. In A. Carsetti (Ed.), *Causality, meaningful complexity and embodied cognition* (pp. 127–134). New York, NY: Springer.

Collins, W. (1986). *No name*. UK: Oxford University Press.

Cook, A. (2010). *Shakespearean neuroplay*. New York, USA: Palgrave Macmillan.

Crossley, S., Cobb, T., & McNamara, D. (2013). Comparing count-based and band-based indices of word frequency. *System*, *41*(4), 965–981. doi:10.1016/j.system.2013.08.002

Dancygier, B., & Sweetser, E. (2014). *Figurative language*. New York, USA: Cambridge University Press.

Dascalu, M. (2014). *Analyzing discourse and text complexity for learning and collaborating*. New York, NY: Springer.

Dumas, D., & Runco, M. (2018). Objectively scoring divergent thinking tests for originality: A re-analysis and extension. *Creativity Research Journal*, *30*(4), 466–468. doi:10.1080/10400419.2018.1544601

Eliot, T. S. (2005). *The annotated waste land with Eliot's contemporary prose*. (L. Rainy, eds.). USA: Yale University Press.

Entman, R. (1993). Framing: Toward clarification of a fractured paradigm. *Journal of Communication*, *43*(4), 51–58. doi:10.1111/j.1460-2466.1993.tb01304.x

Evans, V., & Green, M. (2006). *Cognitive linguistics: An introduction*. UK: Edinburgh University Press Ltd.

Fairhurst, G. (2011). *The power of framing*. San Francisco, USA: Jossey-Bass.

Fairhurst, G., & Sarr, R. (1996). *The art of framing*. San Francisco, USA: Jossey-Bass Publishers.

Fauconnier, G. (2008, October 12). How compression gives rise to metaphor and metonymy. Lecture presented at 9th Conference on Conceptual Structure, Discourse and Language. Case Western University, Ohio.

Fauconnier, G., & Turner, M. (2002). *The way we think*. New York, USA: Basic Books.

Fauconnier, G., & Turner, M. (2006). Compression and global insight. *Cognitive Linguistics*, *11*, 283–304.

Fauconnier, G., & Turner, M. (2008). Rethinking metaphor. In R. Gibbs (Ed.), *The Cambridge handbook of metaphor and thought* (pp. 53–66). UK: Cambridge University Press.

Galvan, S. (2010). Incompleteness, truth, intentionality. In A. Carsetti (Ed.), *Causality, meaningful complexity and embodied cognition* (pp. 113–124). New York, NY: Springer.

Goodheart, E. (2010). On earnest hemingway. In E. Goodheart (Ed.), *Critical insights: Earnest hemingway* (pp. 3–7). Canada: Salem Press.

Gregori-Signes, C., & Clavel-Arroitia, B. (2015). Analysing lexical density and lexical diversity in university students' written discourse. *Procedia - Social and Behavioral Sciences*, *198*, 546–556. doi:10.1016/j.sbspro.2015.07.477

Hakemulder, J. (2000). *The moral laboratory: Experiments examining the effects of reading literature on social perception and moral self-concept*. Amsterdam, The Netherlands: John Benjamins.

Halliday, M. (2004). *An introduction to functional grammar* (3rd ed.). London, UK: Hodder Arnold.

Hemingway, E. (1964). *A moveable feast*. New York, NY: Charles Scribner's Sons.

Hemingway, E., & Plimpton, G. (1958). The art of fiction no. 21. *The Paris Review*, *18*, 66–67.

Ingham, M. (1999). Pound and music. In I. B. Nadel (Ed.), *The Cambridge companion to Ezra Pound* (pp. 236–248). USA: Cambridge University Press.

James, H. (1955). *The notebooks of Henry James*. (F. Matthiessen & K. Murdock, eds.). New York, NY: George Braziller, Inc.

Jarvis, S. (2012). Lexical challenges in the intersection of applied linguistics and ANLP. In C. Boonthum-Denecke, P. McCarthy, & T. Lamkin (Eds.), *Cross-disciplinary advances in applied natural language processing* (pp. 50–72). Pennsylvania, USA: Information Science Reference.

Juanggo, W. (2018). Investigating lexical diversity and lexical sophistication of productive vocabulary in the written discourse of Indonesian EFL learners. *Indonesian Journal of Applied Linguistics*, *8*(1), 38–48. doi:10.17509/ijal.v8i1.11462

Karam, K. (2018). A critical appraisal of Shakespeare's creative conceptual blending of the supernatural and the human in the dramatic composition of *Macbeth*. *Shakespeare Review*, *54*(3), 557–577. doi:10.17009/shakes.2018.54.3.008

Karam, K. (2020). Conscious application of creativity dynamics as an approach to the formation and appreciation of literary creativity. *Neohelicon*. doi:10.1007/s11059-020-00546-x

Karam, K., & Elfiel, H. (2020). An experimental study of the effect of close reading versus casual reading of social drama on the stimulation of the cognitive capacity of empathy. *Scientific Study of Literature*, *10*(1), 36–66. doi:10.1075/ssol.19016.kar

Kenner, H. (1985). *The poetry of Ezra pound*. USA: The University of Nebraska Press.

Kyle, K., Crossley, S., & Berger, C. (2018). The tool for the automatic analysis of lexical sophistication (TAALES): Version 2.0. *Behavior Research*, *50*, 1030–1046. doi:10.3758/s13428-017-0924-4

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

Lakoff, G., & Turner, M. (1989). *More than cool reason*. USA: University of Chicago Press.

Laufer, B., & Nation, P. (1995). Vocabulary size and use: Lexical richness in L2 written production. *Applied Linguistics*, *16*(3), 307–322. doi:10.1093/applin/16.3.307

Leech, G. (1969). *A linguistic guide to english poetry*. New York, USA: Longman Group Ltd.

Lu, X. (2012). The relationship of lexical richness to the quality of ESL learners' oral narratives. *The Modern Language Journal*, *96*(2), 190–208. doi:10.1111/j.1540-4781.2011.01232_1.x

Mar, R., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science*, *3*(3), 173–192. doi:10.1111/j.1745-6924.2008.00073.x

Miall, D. (2019). Towards an empirical model of literariness. *Scientific Study of Literature*, *8*(1), 21–46. doi:10.1075/ssol.00007.mia

Nadel, I. (2007). *The Cambridge introduction to Ezra pound*. UK: Cambridge University Press.

O'Keefe, J., & Nadel, L. (1978). *The hippocampus as a cognitive map*. UK: Oxford University Press.

Palfreyman, D., & Karaki, S. (2019). Lexical sophistication across languages: A preliminary study of undergraduate writing in Arabic (L1) and English (L2). *International Journal of Bilingual Education and Bilingualism*, *22*(8), 992–1015. doi:10.1080/13670050.2017.1326456

Paul, R., & Norbury, C. (2012). *Language disorder from infancy to adolescence* (4th ed.). Missouri, USA: Elsevier.

Poe, E. A. (2012). *Selected poetry and tales*. (J. Hutchisson, eds.). Ontario, Canada: Broadview Edition.

Pound, E. (1957). *Selected poems of Ezra pound*. New York, NY: New Directions Books.

Pound, E. (1968). *Then spirit of romance*. New York, NY: New Directions Books.

Pound, E. (1970). *Gaudier-Brzeska: A memoir*. New York, NY: New Directions Books.

Ravi, K., & Ravi, V. (2017). A novel automatic satire and irony detection using ensembled feature selection and data mining. *Knowledge-Based Systems*, *120*, 15–33. doi:10.1016/j.knosys.2016.12.018

Read, J. (2000). *Assessing vocabulary*. Cambridge: Cambridge University Press.

Runco, M. A. (2016). Commentary: Overview of developmental perspectives on creativity and the realization of potential. In B. Barbot (Ed.), *Perspectives on creativity development* (pp. 97–109). San Francisco, USA: Wiley.

Runco, M. A. (2019). Creativity as a dynamic, personal, parsimonious process. In R. Beghetto & G. Corazza (Eds.), *Dynamic perspectives on creativity* (pp. 181–188). Cham, Switzerland: Springer.

Runco, M. A., & Acar, S. (2012). Divergent thinking as an indicator of creative potential. *Creativity Research Journal*, *24*(1), 66–75. doi:10.1080/10400419.2012.652929

Runco, M. A., Illies, J. J., & Eisenman, R. (2005). Creativity, originality, and appropriateness: What do explicit instructions tell us about their relationships? *The Journal of Creative Behavior*, *39*(2), 137–148. doi:10.1002/j.2162-6057.2005.tb01255.x

Runco, M. A., & Jaeger, G. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*(1), 92–96. doi:10.1080/10400419.2012.650092

Runco, M. A., Turkman, B., Acar, S., & Nural, M. (2017). The idea density and creativity of written works. *Journal of Genius and Eminence*, *2*(1), 26–31. doi:10.18536/jge.2017.04.02.01.03

Salomon, D., & Motta, G. (2010). *Handbook of data compression*. New York, NY: Springer.

Schwartz, S. (1985). *The matrix of modernism*. USA: Princeton University Press.

Shakespeare, W. (1985/2003). In P. Edwards (Ed.), *Hamlet*. Cambridge, UK: Cambridge University Press.

Shivhare, R., & Kumar, C. (2016). On the cognitive process of abstraction. *Procedia*, *89*, 243–252. doi:10.1016/j.procs.2016.06.051

Spiro, R., & Jehng, J. (1990). Cognitive flexibility and hypertext. In D. Nix & R. Spiro (Eds.), *Cognition, education and multimedia* (pp. 163–205). Hillsdale: Lawrence Erlbaum Associates Inc.

Spolsky, E. (2010). Making 'quite anew': Brain modularity and creativity. In L. Zunshine (Ed.), *Introduction to cognitive cultural studies* (pp. 84–102). USA: John Hopkins University Press.

Turkman, B., & Runco, M. (2019). Discovering the creativity of written works: The keywords study. *Gifted and Talented International*, *34*(1–2), 19–29. doi:10.1080/15332276.2019.1690955

Turner, M. (2006). The art of compression. In M. Turner (Ed.), *The artful mind* (pp. 93–115). New York: Oxford University Press.

Turner, M. (2014). *The origin of ideas*. USA: Oxford University Press.

Turner, M., & Fauconnier, G. (1999). A mechanism of creativity. *Poetics Today*, *20*(3), 397–418.

Tyson, L. (2006). *Critical theory today*. New York, NY: Routledge.

Ungerer, F., & Schmid, H. (2006). *An introduction to cognitive linguistics* (2nd ed.). UK: Pearson.

van Peer, W., Hakemulder, J., & Zyngier, S. (2007). *Muses and measures: Empirical research methods for the humanities*. Newcastle: Cambridge scholars Publishing.

Zyngier, S., Bortolussi, M., Chesnokova, A., & Auracher, J. (2008). *Directions in empirical literary studies*. Amsterdam: John Benjamins.