

RIPPLE ENGLISH

ACTIVE LEARNING PROGRAM

Workbook for:

“The Human Brain on Music”

問題は解きっぱなしにしないで！

英語資格試験の学習は、**解いた後の復習をしなければほとんど効果はありません。**答え合わせをしておしまいせずに、**テキストの音読練習やリスニング、多読学習などのインプット学習を何度も反復して記憶に定着させましょう。**ホームページからダウンロードできる音読練習用のテキストをぜひご活用ください。また、数日置いてから再度解き直すのも効果的です。答えを記憶してしまっているかもしれませんが、回答の根拠をなぞりながら繰り返し解くことで有効な復習になります！

The Human Brain on Music

1. Why do we find great joy in music? Interestingly, there is no area of the brain that is dedicated specifically and exclusively to music. Music is like a full-body workout for the brain. Musical activity involves nearly every region of the brain that we know about. For example, a pianist is an expressive artist, a physically skilled athlete, and an individual with remarkable memory and information-processing all at the same time. Their incredible performance is enabled by the highly complex parallel interaction of different parts of the brain.
 2. However, music is not only for experts. Our brain shows incredible performance even when we just listen to music. Most of us become expert listeners by age 6 and are able to form appropriate expectations and understanding of music. The fact that you can listen to and find joy in music is actually supported by intricate functions of the brain, some of which are common to language processing. Understanding why we like music and what draws us to it is a window into the essence of human nature. What functions of the brain enable our ability to enjoy music?
- (1) According to paragraph 1, what does the author mean by saying that music is like "a full-body workout for the brain"?
 - A. Music can replace physical exercise for the body.
 - B. There is no single brain area dedicated to music; rather, nearly every region of the brain is involved.
 - C. Listening to music is more demanding than playing it.
 - D. Music engages only one specialized area but does so very intensely.
 - (2) According to paragraph 2, what does the author claim about non-expert listeners?
 - A. They cannot form appropriate expectations about music until adulthood.
 - B. Most become expert listeners by age 6, capable of forming appropriate expectations about music.
 - C. Their brains process music very differently from professional musicians.
 - D. They can enjoy music only after formal musical training.

3. When we enjoy listening to music, what is happening in the brain? Put simply, the brain derives pleasure from an appropriate level of error in its prediction. When we listen to music, the brain predicts how it will unfold, and emotion arises when these expectations are not met. The pleasure of music depends on how well it strikes an **optimal** balance between aligning with listeners' expectations and properly violating them.
4. In fact, this is not only true in music but also true for everything. According to a theory proposed by British neuroscientist Karl Friston, the purpose of the animal brain is to constantly optimize its internal model and behavior so as to minimize prediction error in sensory input. The brain does not perceive the world passively, but rather proactively predicts the surroundings based on its internal model, or the brain's understanding of the world. At the same time, it is continuously verifying the predictions by referencing the information from sensory organs. For example, when we observe a ball falling toward the ground, the brain predicts how it will fall and bounce based on prior experience. When predictions fail, the brain experiences surprise, and then adjusts the internal model to minimize the surprise.
5. The brain experiences pleasure as it effectively modifies its internal model. In order to avoid dangers and survive, animals must gain a more precise understanding of the world. In other words, prediction error and the subsequent updating of the internal model imply that learning takes place, leading to a more refined understanding of the world. This is the reason why the proper amount of prediction error is the most valuable information for the brain. Too little prediction error means a lack of learning experience, so the brain finds it boring. On the other hand, too much error implies that the existing internal model is significantly wrong, which causes discomfort and anxiety. Music that partly meets the listener's expectations yet introduces a suitable degree of **deviation** provides the brain with auditory input with an optimal level of prediction error.

- (3) The word "optimal" in the passage is closest in meaning to
- A. minimal
 - B. ideal
 - C. unstable
 - D. irregular
- (4) According to paragraph 3, where does the pleasure of music come from?
- A. From completely fulfilling the listener's expectations.
 - B. From an appropriate level of prediction error — striking a balance between meeting and violating expectations.
 - C. From the technical difficulty of the music being performed.
 - D. From the listener's prior knowledge of the composer.
- (5) According to paragraph 4, what is the purpose of the animal brain according to Karl Friston?
- A. To accumulate as much sensory information as possible without modification.
 - B. To passively receive whatever signals come from the sensory organs.
 - C. To constantly optimize its internal model and behavior so as to minimize prediction error in sensory input.
 - D. To memorize the surroundings exactly as they are.
- (6) The word "deviation" in the passage is closest in meaning to
- A. repetition
 - B. departure
 - C. agreement
 - D. shortage
- (7) According to paragraph 5, why is the proper amount of prediction error the most valuable information for the brain?
- A. Because high error always indicates external danger.
 - B. Because too little error means no learning, while too much error means the model is significantly wrong; the proper amount enables learning without anxiety.
 - C. Because it makes music easier to memorize.
 - D. Because it allows the brain to ignore unnecessary input.

6. The fact that we can enjoy music derives from the brain's ability to make predictions. As the music is playing, our brains are thinking ahead to what the different possibilities for the next note are, where the music is going, and so on. When music is too predictable, we find the music boring, and when the music is too unfamiliar, we tend not to like it. In other words, we prefer music with an appropriate balance between familiarity and novelty, simplicity and complexity. It also means that one's musical preference depends on the kind of music they have been exposed to. To put it another way, musical taste is influenced by not only innate factors but also by personal musical experiences, as well as cultural and historical contexts.
7. For example, String Quartet No. 19, composed by Wolfgang Amadeus Mozart in 1785 (K. 465), begins with a heavy introduction marked by striking dissonances, which serves to highlight the bright main section that follows. The dissonant harmonies were so shocking and impressive for the audience at the time that this piece was dubbed "Dissonance." However, to modern listeners, it would not seem particularly unusual because, after Mozart, the use of dissonance as a means of generating tension has become established, and our brains have grown accustomed to such music through repeated exposure.
8. Thus, musical taste is also influenced by the cultural and historical backgrounds. The joy of music has a lot to do with our brain's expectations, which are shaped by what kind of music we have listened to. In other words, music that gains popularity in the future will be that which adds a suitable level of novelty to the features of music that people are already familiar with. In this sense, musicians may not have total freedom of creation in order for their music to be loved by the audience. The trend of music at any given time might be already determined by this structure.
- (8) According to paragraph 6, what determines a person's musical preference?
- A. Only innate genetic factors.
 - B. Only the influence of professional music critics.
 - C. Both innate factors and the music they have been exposed to, including cultural and historical contexts.
 - D. Mainly the price of music in the market.
- (9) The word "dubbed" in the passage is closest in meaning to
- A. named
 - B. criticized
 - C. forgotten
 - D. translated
- ((10) According to paragraph 7, why does Mozart's String Quartet No. 19 ("Dissonance") not sound especially unusual to modern listeners?
- A. Because the dissonant introduction has been removed in modern editions.
 - B. Because audiences today cannot detect dissonance at all.
 - C. Because after Mozart, dissonance as a way of creating tension became established and listeners have grown accustomed to it.
 - D. Because modern listeners only hear the bright main
- (11) According to paragraph 8, what does the author suggest about musicians who want their music to be widely loved?
- A. They are completely free to create whatever they want.
 - B. They must avoid all familiar musical features.
 - C. Their freedom is constrained because they must add only a suitable level of novelty to what audiences already know.
 - D. They should only imitate past masters without any innovation.

9. Understanding music involves various areas of the brain, some of which are also used for processing language. Neurologically, music and language have something in common. One of the most notable commonalities is the processing of pitch. To understand or reproduce music, one has to capture the changes in pitch. Spoken language also involves such variations. Spoken language consists of two elements: linguistic content and prosody. Prosody refers to the combined elements of pitch, rhythm, pauses, and stress in speech, and this passage will focus on pitch as an example.
10. We rely on variations in pitch to interpret the intent of spoken language. For instance, the exact same sentence, such as "I have just finished the exam" can deliver completely different messages depending on the tone of voice. If the tone is positive, it suggests that the test likely went well, whereas a **subdued** tone conveys the opposite implication. Research indicates that people with musical training tend to show greater ability to detect pitch variations in languages.
11. Furthermore, the ability to perceive pitch is particularly important in language acquisition during infancy because children learn the rules of a language with the help of prosodic cues. For example, before mastering grammatical rules, infants can innately distinguish between questions and statements based on the intonation at the end of the sentence. Even before understanding the word order in "Is this a dog?" forms a question, children can recognize it is a question by perceiving the rise in pitch, and then they inductively infer grammatical rules. Thus, prosody is important for both perceiving spoken language and acquiring language. Enjoying music involves refining the ability to perceive, memorize, and reproduce changes in rhythm and pitch in a playful manner. For children, music not only provides pleasure but also offers precious learning opportunities that contribute to language acquisition.

- (12) According to paragraph 9, what is prosody?
- A. The literal meaning of the words spoken in a sentence.
 - B. The combined elements of pitch, rhythm, pauses, and stress in speech.
 - C. The grammatical rules that govern word order.
 - D. A musical genre used in religious services.
- (13) The word "subdued" in the passage is closest in meaning to
- A. cheerful
 - B. muted
 - C. musical
 - D. rapid
- (14) According to paragraph 10, what does the example "I have just finished the exam" illustrate?
- A. That sentence length affects emotional meaning.
 - B. That identical words can carry completely different messages depending on tone of voice (pitch).
 - C. That non-native speakers cannot understand idioms.
 - D. That written language carries the same information as speech.
- (15) According to paragraph 11, how does the example "Is this a dog?" help explain language acquisition in infants?
- A. It shows that infants can identify a question by perceiving the rise in pitch before they understand word order rules.
 - B. It shows that infants memorize sentences word-for-word.
 - C. It shows that infants ignore intonation and focus only on word meaning.
 - D. It shows that infants prefer statements to questions.

12. The joy of music derives from our abilities to analyze and predict its structure, and researchers suggest that this function is similar to syntactic processing in language comprehension. When we comprehend language, phonemes are first integrated into words in the auditory cortex of the temporal lobe, after which syntactic processing takes place across a broad network centered on the frontal lobe. When we listen to music, the brain **bypasses** word recognition, but sequences of sounds are combined in a "syntactic" manner in the frontal lobe directly, where musical meaning is generated. Put differently, when listening to music, we do not perceive each individual note in isolation; rather, we grasp patterns and structures in sequences of sounds to extract meaning, and this process has clear parallels with language comprehension.
13. Let us take an example of the famous "Twinkle Twinkle Little Star." When we listen to this piece, the brain unconsciously remembers that it started on C and which other notes were used, as well as how frequently they occurred. Also, the brain statistically predicts how the melody will unfold based on past musical experiences. When the music resolves on C as expected, the brain experiences a sense of closure, but if it instead unfolds as fa-fa-mi-mi-re-re-so, it gives the impression that the music is still continuing. Furthermore, if this piece is arranged in a minor key, the sequence of re-re-do at the end sounds entirely different in character, even though it consists of the exact same notes as in the major version. A similar process occurs when we hear language. When we listen to the two sentences—"I feel happy when I listen to this music" and "I don't feel happy when I listen to this music"—the brain immediately adjusts its expectations for what follows, depending on the presence or absence of "don't." Thus, comprehending language and music has a lot in common and shares some neurological basis.

- (16) The word "bypasses" in the passage is closest in meaning to
- A. skips over
 - B. depends on
 - C. amplifies
 - D. repeats
- (17) According to paragraph 12, how does the brain process music compared to language?
- A. The brain processes music exactly the same way as it processes individual words.
 - B. Music is processed only in the temporal lobe, never reaching the frontal lobe.
 - C. Music skips word recognition; sound sequences are combined "syntactically" in the frontal lobe to generate meaning, paralleling language comprehension.
 - D. Music is processed solely in the auditory cortex without any structural analysis.
- (18) According to paragraph 13, what does the comparison between the "Twinkle Twinkle" example and the sentences with/without "don't" demonstrate?
- A. That listeners cannot tell major and minor keys apart.
 - B. That language and music are processed independently with no shared mechanisms.
 - C. That for both music and language, the brain immediately adjusts its expectations and interpretation based on key contextual cues (key signature, the word "don't").
 - D. That nursery rhymes are easier to remember than ordinary sentences.

Answers

- (1) B (2) B (3) B (4) B (5) C (6) B
(7) B (8) C (9) A (10) C (11) C (12) B
(13) B (14) B (15) A (16) A (17) C (18) C

(1) 1段落で「音楽は脳の全身運動のようなもの」と表現されている意味として最も適切なものは？

A. Music can replace physical exercise for the body. (音楽は身体的な運動の代わりになる。)

B. There is no single brain area dedicated to music; rather, nearly every region of the brain is involved. (音楽専用の領域はなく、脳のほぼ全領域が関与する。)

C. Listening to music is more demanding than playing it. (音楽を聴くことは演奏することより負荷が大きい。)

D. Music engages only one specialized area but does so very intensely. (音楽は専用領域を一つだけ激しく使う。)

「no area of the brain that is dedicated specifically and exclusively to music」

「involves nearly every region of the brain」と一致。

(2) 2段落によると、専門家でない聴き手について著者は何と述べているか？

A. They cannot form appropriate expectations about music until adulthood. (成人するまで音楽について適切な期待は形成できない。)

B. Most become expert listeners by age 6, capable of forming appropriate expectations about music. (多くは6歳までに「熟達した聴き手」となり、音楽について適切な期待を形成できる。)

C. Their brains process music very differently from professional musicians. (彼らの脳はプロの音楽家とまったく違うやり方で音楽を処理する。)

D. They can enjoy music only after formal musical training. (正式な音楽訓練を受けて初めて音楽を楽しめる。)

「Most of us become expert listeners by age 6 and are able to form appropriate expectations」に対応。

(3) 文中の "optimal (最適な)" と意味が最も近いのは？

A. minimal (最小の)

B. ideal (最適な、理想的な)

C. unstable (不安定な)

D. irregular (不規則な)

(4) 3段落によると、音楽の喜びはどこから生じるか？

A. From completely fulfilling the listener's expectations. (聴き手の期待を完全に満たすことから。)

B. From an appropriate level of prediction error — striking a balance between meeting and violating expectations. (予測の「適度な」誤差から — 期待を満たしつつ適切に裏切るバランス。)

C. From the technical difficulty of the music being performed. (演奏される音楽の技術的難しさから。)

D. From the listener's prior knowledge of the composer. (聴き手の作曲家に関する事前知識から。)

「optimal balance between aligning with listeners' expectations and properly violating them」と一致。

(5) 4段落によると、カール・フリストンが述べる動物の脳の目的は？

A. To accumulate as much sensory information as possible without modification. (感覚情報を改変せず可能な限り多く蓄積すること。)

B. To passively receive whatever signals come from the sensory organs. (感覚器から来る信号を受動的に受け取ること。)

C. To constantly optimize its internal model and behavior so as to minimize prediction error in sensory input. (内部モデルと行動を絶えず最適化し、感覚入力における予測誤差を最小化すること。)

D. To memorize the surroundings exactly as they are. (周囲をそのままの形で記憶すること。)

「optimize its internal model and behavior so as to minimize prediction error」と一致。

(6) 文中の "deviation (逸脱、ずれ)" と意味が最も近いのは？

A. repetition (繰り返し)

B. departure (逸脱、ずれ)

C. agreement (一致)

D. shortage (不足)

(7) 5段落によると、なぜ「適度な予測誤差」は脳にとって最も価値ある情報なのか？

A. Because high error always indicates external danger. (誤差が大きいことは外的危険を示すから。)

B. Because too little error means no learning, while too much error means the model is significantly wrong; the proper amount enables learning without anxiety.

(誤差が小さすぎれば学習がなく、大きすぎれば内部モデルが大きく誤っていることになる。適度な誤差なら不安なく学習が起きるから。)

C. Because it makes music easier to memorize. (音楽の記憶が容易になるから。)

D. Because it allows the brain to ignore unnecessary input. (不要な入力を無視できるから。)

「Too little prediction error means a lack of learning experience...too much error implies that the existing internal model is significantly wrong, which causes discomfort and anxiety」と一致。

(8) 6段落によると、人の音楽の好みを決めるものは？

A. Only innate genetic factors. (生得的な遺伝要因のみ。)

B. Only the influence of professional music critics. (プロの音楽評論家の影響のみ。)

C. Both innate factors and the music they have been exposed to, including cultural and historical contexts. (生得的要因に加えて、個人的な音楽経験や文化・歴史的文脈。)

D. Mainly the price of music in the market. (市場における音楽の価格が主因。)

「influenced by not only innate factors but also by personal musical experiences, as well as cultural and historical contexts」に対応。

(9) 文中の "dubbed (~と名付けられた)" と意味が最も近いのは？

A. named (名付けられた、呼ばれた)

B. criticized (批判された)

C. forgotten (忘れられた)

D. translated (翻訳された)

(10) 7段落によると、なぜモーツァルトの弦楽四重奏曲第19番「不協和音」は現代の聴き手にはそれほど異様に聞こえないのか？

A. Because the dissonant introduction has been removed in modern editions. (現代版では不協和音の序奏が削除されているから。)

B. Because audiences today cannot detect dissonance at all. (現代の聴衆は不協和音をまったく感知できないから。)

C. Because after Mozart, dissonance as a way of creating tension became established and listeners have grown accustomed to it. (モーツァルト以降、緊張を生む手段としての不協和音が定着し、繰り返し聴いて慣れているから。)

D. Because modern listeners only hear the bright main section. (現代の聴き手は明るい主部しか聴かないから。)

「after Mozart, the use of dissonance as a means of generating tension has become established, and our brains have grown accustomed to such music through repeated exposure」と一致。

(11) 8段落によると、聴衆に広く愛される音楽を作りたい音楽家について著者は何を示唆しているか？

A. They are completely free to create whatever they want. (やりたいことを完全に自由に作れる。)

B. They must avoid all familiar musical features. (おなじみの音楽的特徴をすべて避けるべきである。)

C. Their freedom is constrained because they must add only a suitable level of novelty to what audiences already know. (聴き手が既に親しんでいるものに「適度な新奇さ」を加えるしかいないため、創作の自由はある程度制約される。)

D. They should only imitate past masters without any innovation. (革新は一切せず、過去の巨匠を模倣すべきである。)

「musicians may not have total freedom of creation」「adds a suitable level of novelty to the features of music that people are already familiar with」と一致。

(12) 9段落によると、プロソディーとは何か？

A. The literal meaning of the words spoken in a sentence. (文中で話される語の字義的な意味。)

B. The combined elements of pitch, rhythm, pauses, and stress in speech. (話し言葉におけるピッチ、リズム、休止、強勢の要素を合わせたもの。)

C. The grammatical rules that govern word order. (語順を支配する文法規則。)

D. A musical genre used in religious services. (宗教儀式で用いられる音楽ジャンル。)

「Prosody refers to the combined elements of pitch, rhythm, pauses, and stress in speech」と一致。

(13) 文中の "subdued (抑えた、控えめな)" と意味が最も近いのは？

A. cheerful (陽気な)

B. muted (抑えた、控えめな)

C. musical (音楽的な)

D. rapid (速い)

(14) 10段落の「I have just finished the exam」という例が示すものは？

A. That sentence length affects emotional meaning. (文の長さが感情的意味に影響する。)

B. That identical words can carry completely different messages depending on tone of voice (pitch). (同じ語でも声の調子(ピッチ)によってまったく異なるメッセージを伝えうる。)

C. That non-native speakers cannot understand idioms. (非ネイティブはイディオムを理解できない。)

D. That written language carries the same information as speech. (書き言葉は話し言葉と同じ情報を伝える。)

「the exact same sentence...can deliver completely different messages depending on the tone of voice」と一致。

(15) 11段落の「Is this a dog?」の例は、乳児の言語獲得をどう説明するのに役立つか？

A. It shows that infants can identify a question by perceiving the rise in pitch before they understand word order rules. (語順のルールを理解する前から、ピッチの上昇を感じ取ることで疑問文と判別できることを示す。)

B. It shows that infants memorize sentences word-for-word. (乳児は文を語単位で丸暗記することを示す。)

C. It shows that infants ignore intonation and focus only on word meaning. (乳児はイントネーションを無視し語の意味だけに注目することを示す。)

D. It shows that infants prefer statements to questions. (乳児は疑問文より平叙文を好むことを示す。)

「children can recognize it is a question by perceiving the rise in pitch, and then they inductively infer grammatical rules」と一致。

(16) 文中の "bypasses (-を経由しない、迂回する)" と意味が最も近いのは？

A. skips over (飛ばして通り過ぎる、迂回する)

B. depends on (-に依存する)

C. amplifies (増幅する)

D. repeats (繰り返す)

(17) 12段落によると、脳は音楽と言語をどう比較できる形で処理しているか？

A. The brain processes music exactly the same way as it processes individual words. (音楽は個々の語と同じ手順で処理される。)

B. Music is processed only in the temporal lobe, never reaching the frontal lobe. (音楽

は側頭葉のみで処理され、前頭葉には届かない。)

C. Music skips word recognition; sound sequences are combined "syntactically" in the frontal lobe to generate meaning, paralleling language comprehension. (音楽では語の認識を飛ばすが、音の列が前頭葉で「統語的」に結合されて意味が生成され、言語理解と並行する。)

D. Music is processed solely in the auditory cortex without any structural analysis. (音楽は構造分析なしに聴覚野だけで処理される。)

「the brain bypasses word recognition, but sequences of sounds are combined in a 'syntactic' manner in the frontal lobe directly」と一致。

(18) 13段落の「Twinkle Twinkle」の例と「don't」の有無の文例の比較が示すものは？

A. That listeners cannot tell major and minor keys apart. (聴き手は長調と短調を区別できない。)

B. That language and music are processed independently with no shared mechanisms. (言語と音楽は完全に独立に処理され、共通の仕組みはない。)

C. That for both music and language, the brain immediately adjusts its expectations and interpretation based on key contextual cues (key signature, the word "don't"). (音楽でも言語でも、脳は調性や「don't」のような重要な文脈手がかりに応じて即座に期待と解釈を調整する。)

D. That nursery rhymes are easier to remember than ordinary sentences. (童謡は通常の文より覚えやすい。)

「the brain immediately adjusts its expectations for what follows, depending on the presence or absence of 'don't.'」「comprehending language and music has a lot in common and shares some neurological basis」と一致。