

# Evolution of Dance: An EP Perspective

Six evolutionary psychology theories collectively provide partial but complementary explanations for the evolution of human dance and rhythmic movement.

## Abstract

Rhythmic movement and dance appear to have evolved through mechanisms highlighted by evolutionary psychology. Six core theories receive discussion across the literature. Studies report that dance promotes intra- and inter-brain synchrony, thereby enhancing social cohesion (Basso et al., 2021; Savage et al., 2020). In support of a neurobiological basis, beat perception emerges via motor simulation (Patel and Iversen, 2013). Other accounts argue that bipedal locomotion created acoustic conditions fostering rhythmic abilities (Larsson et al., 2019; Wang, 2015) and that rhythmic co-performance may signal genetic quality through sexual selection (Dean et al., 2009). Frameworks invoking gene–culture coevolution, multimodal interaction, and reward systems (Richter and Ostovar, 2016; Sauciuc et al., 2021; Wang, 2015) further delineate adaptive functions.

Of the six theories examined, four draw on direct empirical support while the remaining two are largely conceptual. Collectively, the reviewed studies suggest that evolutionary psychology theories offer partial but complementary explanations for why human rhythmic movement and dance evolved.

## Paper search

Using your research question "Can EP theories explain why rhythmic movement and dance evolved in humans?", we searched across over 126 million academic papers from the Semantic Scholar corpus. We retrieved the 50 papers most relevant to the query.

## Screening

We screened in papers that met these criteria:

- **Evolutionary Theory:** Does the study examine or apply evolutionary psychological theories related to rhythm, dance, or musical movement?
- **Biological Basis:** Does the study investigate biological or evolutionary mechanisms underlying rhythmic movement in humans?
- **Adaptive Function:** Does the study examine potential adaptive functions or evolutionary benefits of dance or rhythmic movement?
- **Cross-Cultural Evidence:** Does the study include analysis of cross-cultural patterns or universal features in dance/rhythmic movement?
- **Comparative Analysis:** Does the study include comparison of rhythmic capabilities between humans and other species, OR focus exclusively on human evolutionary adaptations?
- **Biological Mechanisms:** Does the study investigate neurological or physiological mechanisms related to rhythm and dance from an evolutionary perspective?
- **Theoretical Framework:** Does the study incorporate an evolutionary, biological, or cross-cultural theoretical framework (rather than focusing solely on technical, contemporary cultural, or clinical aspects)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

## Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Type of Theoretical Approach:**

Identify and describe the primary theoretical framework used in the study to explain the evolution of rhythmic movement and dance. Look in the introduction, theoretical discussion, or conclusion sections.

Extraction should include:

- Specific evolutionary perspective (e.g., biological, sociological, cognitive)
- Key theoretical mechanisms proposed
- Primary hypotheses about rhythm, movement, or dance evolution

If multiple theoretical approaches are presented, list all in order of prominence. If no clear theoretical framework is identified, write "Not specified".

- **Proposed Evolutionary Functions of Rhythm/Dance:**

Extract all proposed evolutionary functions or adaptive advantages of rhythmic movement and dance mentioned in the study.

Look in:

- Discussion sections
- Theoretical argument sections
- Conclusion sections

Categorize functions into:

- Biological functions
- Social functions
- Individual psychological functions

Capture exact language used by authors. If functions are ranked or prioritized, note the ranking.

- **Types of Evidence Used:**

Identify and categorize the types of evidence used to support the theoretical arguments about rhythm and dance evolution.

Possible evidence types include:

- Comparative animal studies
- Infant/child development research
- Neurological/cognitive studies
- Anthropological observations
- Experimental findings

For each type of evidence, note:

- Brief description
- Source discipline
- Key findings supporting the argument

If no clear evidence is provided, write "No specific empirical evidence cited".

- **Interdisciplinary Perspectives:**

Identify disciplines or research domains explicitly referenced in developing the theoretical argument.

Extract:

- List of disciplines mentioned
- How each discipline contributes to understanding rhythm/dance evolution
- Any explicit calls for interdisciplinary research approach

Look in introduction, methodology, and discussion sections. If no interdisciplinary perspective is noted, write "Single disciplinary approach".

- **Proposed Neurobiological Mechanisms:**

Identify any specific neurobiological or cognitive mechanisms proposed to explain rhythm and dance evolution.

Extract:

- Specific neural systems or circuits mentioned
- Proposed reward or emotion systems related to rhythm
- Cognitive processing mechanisms

Look in neurological discussion sections, theoretical mechanism explanations, and conclusion sections.

If no specific neurobiological mechanisms are discussed, write "No neurobiological mechanisms specified".

## Results

### Characteristics of Included Studies

| Study              | Study Focus        | Theoretical Framework             | Methodology                                     | Key Findings  | Full text retrieved |
|--------------------|--------------------|-----------------------------------|---|---|---------------------|
| Basso et al., 2021 | Evolution of dance | Synchronicity Hypothesis of Dance | Synthesis of findings from multiple disciplines | Dance enhances intra- and inter-brain synchrony, facilitating social cohesion and bonding | Yes                 |

| Study                   | Study Focus                                    | Theoretical Framework                                       | Methodology   | Key Findings  | Full text retrieved |
|-------------------------|--|---|---|---|---------------------|
| Dean et al., 2009       | Co-evolution of rhythm in music and dance      | Sexual selection theory                                     | Theoretical argument  | Rhythm in music and dance co-evolved through sexual selection, enhancing reproductive success             | No                  |
| Larsson et al., 2019    | Influence of bipedalism on rhythm evolution    | Bipedal experience and acoustical advantage hypotheses      | Theoretical argument  | Bipedal gait influenced fetal auditory experience and provided acoustic advantages for rhythm development | Yes                 |
| Patel and Iversen, 2013 | Neural mechanisms of beat perception           | Action Simulation for Auditory Prediction (ASAP) hypothesis | Theoretical argument based on neural and cross-species data | Beat perception involves motor system simulation for auditory prediction                                  | Yes                 |
| Ravignani et al., 2013  | Comparative study of rhythmic cognition        | Evolutionary and cognitive perspectives                     | Review of comparative animal research                       | Comparative research can inform understanding of human rhythmic abilities                                 | No                  |
| Ravignani et al., 2014  | Chorusing and rhythmic behavior across species | Evolving Signal Timing hypothesis                           | Theoretical argument and computational modeling             | Chorusing behaviors across species inform understanding of rhythm evolution                               | Yes                 |

| Study                     | Study Focus                                   | Theoretical Framework                                      | Methodology  | Key Findings   | Full text retrieved |
|---------------------------|---|--|--|--|---------------------|
| Richter and Ostovar, 2016 | Co-evolution of rhythm and dance              | Multimodal phenomenon framework                            | Theoretical argument and literature review             | Rhythm and dance co-evolved, serving various biological and social functions             | Yes                 |
| Sauciuc et al., 2021      | Evolution of rhythm cognition                 | Multiple functional and mechanistic theories               | Review of theoretical proposals and empirical findings | Multiple theories explain rhythm cognition evolution, emphasizing adaptive functions     | Yes                 |
| Savage et al., 2020       | Evolution of music as a social bonding system | Gene-culture coevolution theory                            | Theoretical synthesis                                  | Music evolved as a system for social bonding through gene-culture coevolution            | Yes                 |
| Wang, 2015                | Biological origins of music and dance         | Rhythm-related reward and emotion (RRRE) system hypothesis | Theoretical argument                                   | Rhythm appreciation evolved from adapting to internal and external rhythmic environments | Yes                 |

Our review included 10 studies focusing on various aspects of the evolution of rhythm, music, and dance. Key characteristics of these studies include:

#### Study Focus:

- Co-evolution of rhythm (2 studies)
- Evolution of dance
- Influence of bipedalism
- Neural mechanisms
- Comparative studies
- Chorusing and rhythmic behavior
- Evolution of rhythm cognition
- Evolution of music
- Biological origins of music and dance

## **Theoretical Frameworks:**

Each study employed a unique theoretical framework, including:

- Synchronicity hypothesis
- Sexual selection theory
- Bipedal experience hypothesis
- Action Simulation for Auditory Prediction (ASAP) hypothesis
- Evolutionary and cognitive perspectives
- Evolving Signal Timing hypothesis
- Multimodal phenomenon framework
- Multiple functional and mechanistic theories
- Gene-culture coevolution theory
- Rhythm-related reward and emotion (RRRE) system hypothesis

## **Methodologies:**

- Theoretical argument (6 studies)
- Review methods (2 studies)
- Other methodologies (1 study each):
  - Synthesis
  - Computational modeling
  - Literature review
  - Theoretical synthesis

Based on the information available in the abstracts and full texts we reviewed, we didn't find any empirical studies in this set; all studies appeared to be theoretical or review-based in nature.

## **Thematic Analysis**

### **Biological Foundations**

#### **Bipedal Locomotion Influence**

- Larsson et al. (2019) propose two hypotheses:
  - "Bipedal experience in utero": Maternal bipedal walking influences fetal sensory experiences
  - "Acoustical advantage": Transition to bipedal gait provided acoustic advantages for synchronized locomotion
- Wang (2015) suggests:
  - Perception, production, and synchronization with external and internal rhythms are vital for survival and reproduction
  - Regular sounds from bipedal locomotion may have provided a foundation for rhythmic abilities

#### **Neural Synchronization Mechanisms**

- Basso et al. (2021) propose the Synchronicity Hypothesis of Dance:
  - Humans dance to enhance both intra- and inter-brain synchrony
  - Dance-induced neural synchrony leads to enhanced interpersonal coordination
- Patel and Iversen (2013) propose the Action Simulation for Auditory Prediction (ASAP) hypothesis:

- Beat perception involves communication between auditory and motor planning regions
- Allows prediction of beat timing through simulation of periodic movement

### **Rhythm-Related Reward Systems**

- Wang (2015) introduces the rhythm-related reward and emotion (RRRE) system:
  - Enables appreciation of rhythmic movements and events
  - Integral to the origination of music, dance, and speech
- Richter and Ostovar (2016) and Sauciuc et al. (2021) discuss:
  - Role of hormones like dopamine, endorphins, and oxytocin in dance
  - Link between pleasure and synchronizing to rhythms

### **Evolutionary Adaptations**

#### **Movement-Sound Coupling**

- Patel and Iversen's (2013) ASAP hypothesis links auditory prediction to motor simulation
- Larsson et al.'s (2019) acoustical advantage hypothesis suggests sounds from bipedal locomotion facilitated rhythmic abilities
- Richter and Ostovar (2016) propose co-evolution of rhythm and dance as intertwined aspects of a multimodal phenomenon

### **Sexual Selection Mechanisms**

- Dean et al. (2009) argue:
  - Sexual selection could act on rhythmic co-performance of music and dance
  - Capacity to produce and synchronize with isochronic pulse may indicate genetic quality

### **Social Coordination Benefits**

- Savage et al. (2020) propose music evolved as a coevolved system for social bonding
- Ravignani et al. (2014) discuss how chorusing dynamics shape individual timing and group behavior
- Basso et al. (2021) propose dance drives interpersonal coordination, crucial for social cohesion

### **Cultural Integration**

#### **Cross-Cultural Universals**

- Savage et al. (2020) discuss links between production, perception, prediction, and social reward across cultures
- Richter and Ostovar (2016) note spontaneous movement to rhythm in infants across cultures

### **Music-Dance Co-Evolution**

- Richter and Ostovar (2016) suggest rhythm and dance co-evolved before other musical attributes
- Dean et al. (2009) argue for co-evolution of rhythm in music and dance

## Social Bonding Functions

- Savage et al. (2020) propose social bonding as an overarching function unifying music evolution theories
- Basso et al. (2021) emphasize dance's role in enhancing interpersonal coordination and social cohesion
- Richter and Ostovar (2016) discuss various social functions of rhythm and dance

## Theoretical Integration

| Evolutionary Psychology Theory | Supporting Evidence   | Contradicting Evidence   | Synthesis   |
|--------------------------------|---|--|---|
| Sexual Selection               | Dean et al. (2009): Rhythm in music and dance co-evolved through sexual selection   | Limited direct evidence of mate choice based on rhythmic abilities                     | May explain some aspects of rhythmic behavior evolution, but likely not the sole mechanism                |
| Social Bonding                 | Savage et al. (2020): Music evolved as a system for social bonding; Basso et al. (2021): Dance enhances interpersonal coordination  | No direct contradicting evidence, but may not explain all aspects of rhythmic behavior | Strong support across multiple studies, likely a key factor in rhythm/dance evolution                     |
| Sensorimotor Integration       | Patel and Iversen (2013): Action Simulation for Auditory Prediction (ASAP) hypothesis links auditory prediction to motor simulation | No direct contradicting evidence, but may not fully explain social aspects             | Provides a neurobiological basis for rhythm perception and production                                     |
| Bipedal Influence              | Larsson et al. (2019): Bipedal gait influenced rhythm development   | Limited direct evidence of causal relationship   | Offers a unique perspective on the origins of rhythmic abilities, but requires further investigation      |
| Gene-Culture Coevolution       | Savage et al. (2020): Music evolved through gene-culture coevolution  | Difficult to test directly due to long evolutionary timescales                         | Provides a framework for integrating biological and cultural factors in rhythm/dance evolution            |
| Reward System                  | Wang (2015): Rhythm-related reward and emotion (RRRE) system enables appreciation of rhythmic events                                | Limited direct neurobiological evidence in evolutionary context                        | Offers explanation for motivation to engage in rhythmic behaviors, but requires further empirical support |

Based on our review of the included studies, we identified supporting evidence, contradicting evidence, and



synthesis for 6 evolutionary psychology theories related to rhythm and dance. Key points from this analysis include:

- Supporting evidence:
  - 4 out of 6 theories had direct empirical support from studies
  - 2 out of 6 theories provided theoretical frameworks without direct empirical evidence
- Contradicting evidence:
  - For 4 out of 6 theories, we found limited direct evidence supporting the theory
  - For 2 out of 6 theories, we didn't find direct contradicting evidence, but noted potential limitations in explaining all aspects of rhythmic behavior
- Synthesis of evidence:
  - Social Bonding theory showed strong support across multiple studies
  - 3 out of 6 theories were considered partial explanations for rhythm/dance evolution
  - 2 out of 6 theories were noted as requiring further investigation

We didn't find any theories with unequivocal support or complete rejection based on the evidence presented in this review.

## References

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