What Binds Non-Contiguous Events Together?

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Abstract

Traditional event cognition research typically characterises events as continuous, each bounded by a single beginning and a single ending. Daily events, however, often seem to involve discontinuities. For instance, if one is in a meeting that is temporarily interrupted by a phone call, one retains two events—the meeting and the phone call—rather than three, which include the meeting before the phone call, the phone call itself, and the meeting subsequent to the call. This study explores what binds events together across these discontinuities in everyday life. We examined five potential binding factors: place, people, topic, activity, and goal. Fifty-one participants provided data on recent non-contiguous daily life events, revealing that 97% of these events were tied by the 'Activity' aspect, followed by the 'Place' aspect (82%) and 'Goal' aspect (56%). 'People' (48%) and 'Topic' aspects (24%) were less significant in unifying non-contiguous events. The proportion of each event aspect in non-contiguous events suggests a need to expand theories of event cognition to focus on what brings events together rather than solely on what separates them—a perspective often overlooked in cognitive event theories.

Keywords: Daily life events; Non-contiguous events; Event cognition.

Introduction1111

In daily lives, we constantly navigate a stream of activities. However, when we perceive, recall, and talk about these experiences, we tend to refer to them as discrete 'event units'. The debate on the definition of 'events' continues in contemporary discourse (Yates, Sherman, & Yousif, 2023). Prevailing theories in event cognition frequently portray events as discrete, interconnected entities grounded in a temporal framework, emphasising their contiguous nature (Zacks & Tversky, 2001; Radvansky & Zacks, 2017). According to Zacks and Tversky (2001), an event is defined as 'a segment of time at a specific location with a clear start and end.' Indeed, Yates et al. (2023) characterise events as 'periods' occurring within extended temporal intervals, potentially encompassing multiple 'moments'.

However, in our daily experiences, we frequently face overlapping or interrupted events, such as cooking dinner while chatting with our partner or watching a movie and receiving an unexpected phone call from a close friend. Previous research by Yates et al. (2023), Sastre Gomez, Defina, Garrett, Zacks, & Dennis (2023), Kubovy (2020), and Schank & Abelson (1977) supports the notion that events are often non-contiguous. In this paper, we investigate non-contiguous events outside the laboratory and explore aspects other than temporal contiguity—such as location, people, activity, or topic—that may unify them into a single event.

Events may exhibit temporal gaps, as Zacks and Tversky (2001) indicated, or they may co-occur, as observed by Sastre Gomez et al. (2023). Discontinuities in daily life have been a subject of investigation in various psychology subfields, including perception, attention, and memory (Linton, 1986; Barsalou, 1988; Kubovy, 2015, 2020; Jeong & Fishbein, 2007; Salvucci & Taatgen, 2008). Consequently, various theories (e.g., threaded cognition theory), concepts (e.g., 'extender,' 'strands,' 'extended events'), and types ('interdigitated,' 'overlap,' etc.) have been designated to explain situations involving temporal discontinuities.

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However, the domain of event cognition still presents a notable lack of research exploring or integrating non-contiguous events in daily life (Yates et al., 2023; Sastre Gomez et al., 2023).

In previous work, Burt, Kemp, and Conway (2003) found that approximately 70% of participants' reported events were combination episodes across multiple time points. These findings suggest that non-contiguous events constitute a significant component of daily events. In another study of daily events, Sastre Gomez and colleagues (2003) asked participants to document events within four different time windows, including their start and finish times during a micro-survey. Their results showed that 45% of responses involved non-contiguous events. The findings suggest that participants reported engaging in multiple concurrent events, with the prevalence of simultaneous events being the dominant form of non-contiguity.

There is also evidence to suggest that discontinuities in daily life can assume various distinct forms (Kubovy, 2015, 2020; Jeong & Fishbein, 2007; Salvucci & Taatgen, 2008; Burt, et al., 2003; Sastre Gomez et al., 2023). For example, Sastre Gomez et al. (2023) found in their qualitative findings on multitasking behaviours that different types of patterns emerge when events are non-contiguous. For instance, two events could overlap with the same start and end times. Another form of co-occurrence involved shorter events occurring within longer ones. Additionally, Sastre Gomez et al. (2023) observed instances where events reported as simultaneous might seem interrupted or remain on standby while participants resume another event.

Thus, Sastre's findings resonate with Yates et al. (2023), who argue that everyday life is not necessarily sequential but characterised by various discontinuities, interruptions, overlaps, and embedded events. Despite prior references to various types of non-contiguous events, we have not encountered studies that employ a particular typology of discontinuities in event research. Therefore, for the purposes of our current investigation, our study identified four logical types of non-contiguous events: interrupted, simultaneous, interdigitated, and chained (See Figure 1).

Interrupted events refer to situations in which an ongoing Event A is momentarily disrupted by a brief Event B but subsequently resumed following the interruption (see also Schank & Abelson, 1977; Kominsky et al., 2021). For example, receiving a phone call while actively participating in a business meeting.

Interdigitated events pertain to engaging in two concurrent activities by switching attention between them. Specifically, Event A is interdigitated with Event B and, optionally, Event C. This category accords with the threaded cognition theory (Salvucci & Taatgen, 2008). For example, exchanging messages with a friend while cooking dinner.

Simultaneous events refer to the occurrence of two or more events at the same time. A crucial differentiation with interdigitation lies in the continuous engagement with both events rather than alternating between them. Simultaneous occurrence of events A, B, and optionally C is observed. For example, joining an online lecture while travelling on the train to the university. Simultaneity has gained scholarly attention in education due to the rise of digital technology (e.g., Zhou & Deng, 2022).

Chained events occur when an event occurs in small instalments, which are chained together with possibly lengthy periods of other activities in between. Typically, each instalment of the chained event A is relatively short compared with the gaps between instalments. The chained event type prioritises thematic relevance over time and is linked to 'extended events' organised around shared goals (Linton, 1986; Conway, 1992, 1996; Barsalou, 1988). For instance, imagine engaging in an email conversation with your PhD supervisor about the process of writing a paper and preparing comments for its further improvement and publication.

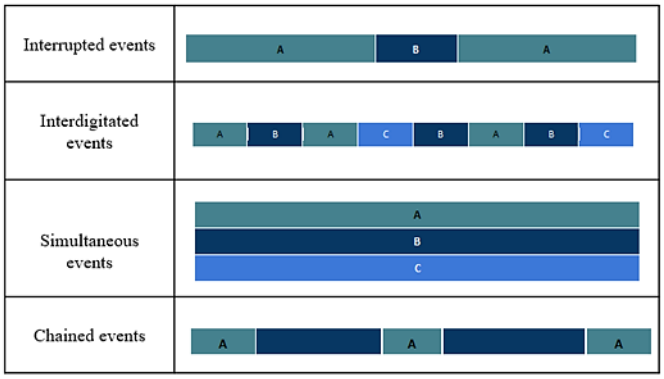

Figure 1. Non-contiguous event categories.

In the field of event cognition, there has been a significant focus on the concept that events can be unified or integrated through a set of interconnected factors (Zacks & Tversky, 2001). Theories of situation models propose that people are able to represent events occurring within a shared spatiotemporal framework (e.g., the event-indexing model; see also Zwaan & Radvansky, 1998; Radvansky, Zwaan, Federico & Franklin, 1998). Moreover, they suggest that temporal structure significantly impacts memory retrieval and is crucial for narrative comprehension, which explains why most studies have prioritised time as a factor that allows integration into a single model (Zwaan, Langston, & Graesser, 1995a; Zwaan, Magliano, & Graesser, 1995b; Radvansky et al.,1998; Zacks & Tversky, 2001).

However, people seem to have the ability to represent events not only in relation to time but also across at least four additional dimensions: space, entities such as people and objects, themes, and intentionality/goal (Zwaan et al., 1995a; Zwaan et al., 1995b; Radvansky et al.,1998; Zwaan & Radvansky, 1998; Kurby & Zacks, 2019; Zacks, Tversky, & Iyer, 2001; Zacks, 2020). For instance, Travis (1997) conducted a study highlighting infants' ability to discern the organisation of events based on their goals. They found that even 2-year-olds, when asked to reenact what they observed, tended to group actions with similar goals and prioritise

replicating goal-oriented actions, even though the events were mixed with other actions.

The study revolves around the personal life experiences of participants, aiming to characterise aspects of events—such as place, people, topic, activities, and goals—that bridge different kinds of non-contiguity in people's daily lives.

Methods

Participants

A group of fifty-three participants from the School of Psychology at Melbourne University was recruited through the Research Experience Program (REP) in exchange for academic credits. All participants were first-year students studying psychology. Two participants were excluded due to not completing the survey. The final sample size of fifty-one participants comprised 36 females, 14 males, and one participant who identified as gender non-conforming. The age range of the participants fell between 18 and 23 years, with an average age of 19.47 years and a standard deviation of 1.10.

Materials

A survey, comprising three main sections, was designed to explore non-continuous events. The first section includes a definition and examples of interrupted, simultaneous, interdigitated, and chained events to make sure that all participants had a common understanding of each type of non-contiguous event. The second section asked participants to give examples of each type of non-contiguous event, and the third section required them to organise their examples in a standard structure.

To create the non-contiguous survey, four experts categorised 40 events into contiguous and non-contiguous categories using examples from the multitasking dataset (Sastre Gomez et al., 2023). The validation form included descriptions of five event categories and a table with examples of events, including their start and end times. A Kappa analysis revealed a substantial level of agreement among the experts (Kappa= 0.66) by Landis and Koch (1977) criteria.

Procedure

Participants were asked to read definitions and examples of each type of non-contiguous event, then to recall their recent activities and match them to the non-contiguous event categories. Each event description was required to contain at least 15 words (see Figure 2, top), and participants were required to list at least three events for each category. In the last section of the survey, respondents were asked to identify the A event and B event within each of the descriptions they had previously provided (see Figure 2, bottom). The final two questions concerned socio-demographic information such as age and gender. Compliance was high: participants responded to 100% of the survey questions.

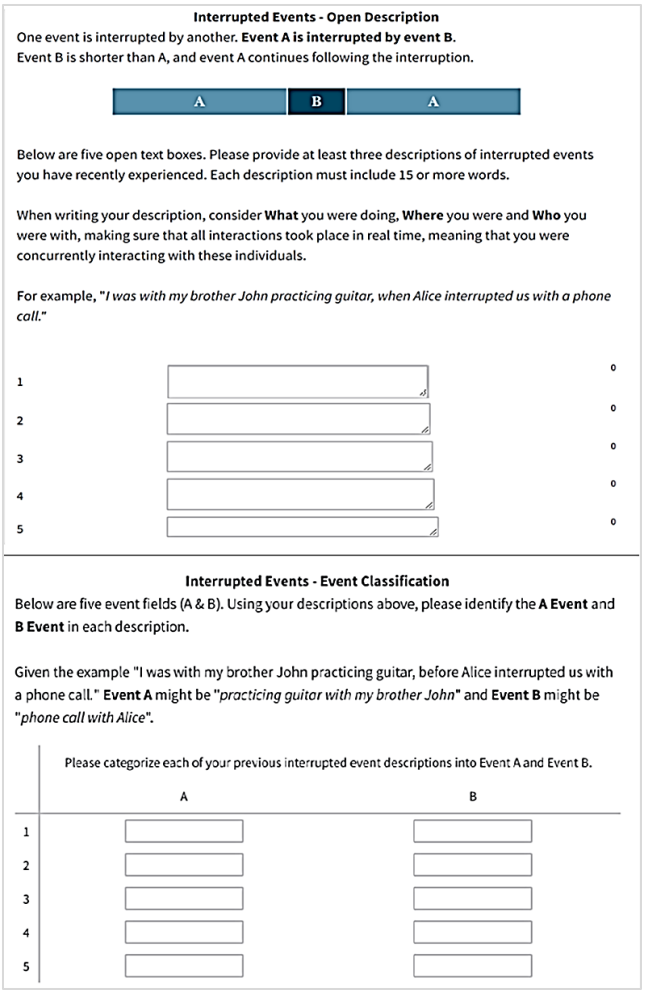

Figure 2. Non-contiguous events survey - examples from the second and third sections.

Data analysis

Two experts independently coded four non-contiguous events across five aspects: place, people, topic, activity, and goal. Coding determined whether each aspect unified the non-contiguous events, using three categories ('Yes,' 'No,' or 'Do Not Know'). 'Yes' indicated unification, 'No' meant that the particular aspect did not contribute to the unification of the event, and 'Do Not Know' was chosen when explicit information was absent or when the provided examples lacked sufficient details regarding the considered aspect. Peer review assessed judgment consistency, revealing a substantial agreement (Kappa = 0.87) by Landis and Koch (1977) criteria.

Results and Discussion

Initially, we collected a total of 1,056 events, but 257 were subsequently excluded as they did not meet the criteria for classification as non-contiguous events. As a result, the final dataset comprised 799 events (See Table 1 for event category breakdown).

Table1. Overview of Non-Contiguous Event Sample

Non-contiguous Event categories	Frequency
Interrupted Event	178
Simultaneous Events	312
Interdigitated Events	178
Chain of Events	131
Total	799

The 'activity' aspect was consistent across 0.97 of non-contiguous events, trailed by the 'place' aspect (0.82) and 'goal' aspect (0.56). 'People' (0.48) and 'topic' aspects (0.24) were consistent in less than half of these events. Figure 3 illustrates the aspect proportions across different non-contiguous event categories.

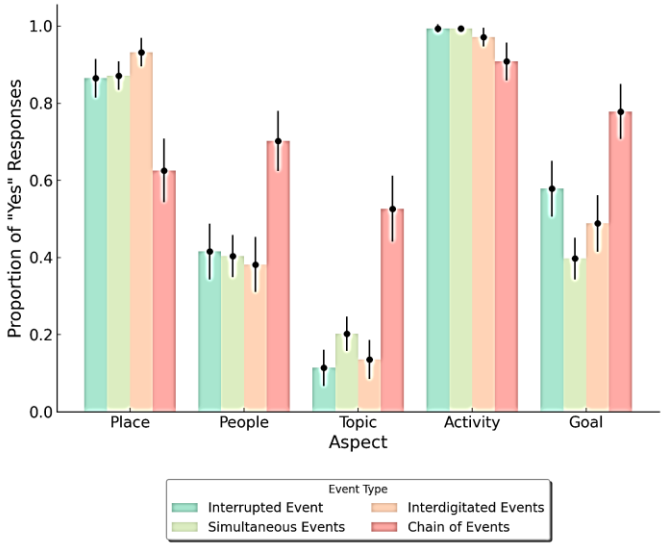

Figure 3: Event aspect emphasis in different types of non-contiguous events (n=799 events). Error bars display 95% confidence intervals.

As is shown in Figure 3, the 'activity' aspect exhibited consistency across all event types, with the highest consistency being in interrupted (0.99) and simultaneous (0.99) events, followed by interdigitated (0.97) and chained events (0.91). This potentially indicates its capacity to unify events across different discontinuities. In particular, interrupted, overlapped, or interdigitated events showed higher consistency in the activity aspect compared to chained events.

Simultaneous events were characterised by recurrent activities featuring common combinations like watching TV and eating or listening to music while engaging in another task. Following are some examples provided by participants:

I was listening to music on my speaker alone when I was cleaning my room.

I was eating lunch with my family in the living room whilst watching the international News.

A qualitative analysis of the 'activity' aspect revealed that, in simultaneous events, certain activities overlapped more frequently than others. This aligns with prior research (e.g., Cao, Lee et al., 2001; Jeong & Fishbein, 2007; Sastre Gomez et al., 2023) highlighting how specific tasks demand varying attentional resources influenced by factors like task difficulty, autonomy, compatibility, and individuals' prior experience.

The 'place' aspect displayed large percentages for interdigitated (0.93), interrupted (0.87), and simultaneous events (0.87). Below are illustrative examples of non-contiguous events that were unified by the place aspect:

Interrupted *I was studying for my biology test in my room, not long after my friend called me and asked to get lunch.*

Simultaneous *I was by myself eating dinner while watching Netflix on the couch in the living room.*

Interdigitated *I watch YouTube in the kitchen while watching the soup cooking on the stove top.*

Exceptions occurred when individuals were in transit. Below are representative examples of these occurrences.

I was walking to university for a Psychology class while talking to my mum on the phone.

I was talking to my friend while driving both of us in the car to the train station.

In contrast, a notable trend observed in chained events was the lack of evident spatial unity or disunity. This ambiguity in chained events can be attributed to their unique characteristics. For instance, engaging in an extended conversation or a sequence of phone calls can take place either in the same physical or virtual location or across different locales, and it was often not clear from the participants' descriptions which was the case. The following participant examples serve to illustrate the previously discussed trend.

Last week, I had a lengthy chat with my mum about my future plans after university.

I had a series of phone calls with my doctor's office and the pharmacy in order to refill my prescription.

Our observations indicate that simultaneous events are more likely to coincide with changes in location when

compared to interrupted and interdigitated events. Hence, these disparities could suggest inherent variations in the characteristics associated with each type of non-contiguous event.

These findings support the significance of locations (Doherty & Smeaton, 2008; Zwaan et al., 1995; Zhuang, Belkin, & Dennis, 2012). Moreover, our results also align with the work of Zwaan et al. (1998), highlighting the relevance of place in situation models, as it aids in associating protagonists with specific spatial locations and contributes to the formation of coherent situation models.

In the 'people' aspect, our analysis focused on the involvement of another person in the event. In Figure 3, events with another person were coded as "Yes", whereas events lacking an interaction with someone were coded as 'No'. Our findings revealed that interrupted events (0.42), interdigitated events (0.40), and simultaneous events (0.38) generally occurred independently with limited interaction.

Below, we provide some specific examples.

Interrupted — *I was at my bedroom studying my course materials, when I was interrupted by a phone call from my friend.*

Simultaneous — *I was cleaning and tidying up my bedroom while listening to music using my headphones.*

Interdigitated — *I was cleaning my kitchen while going back and forth watching a show on Netflix.*

In contrast, chained events often involved people (0.70), and most events explicitly mentioned their interactions. A specific example is provided following.

> *This week, I had a long group chat message with my friends about some gossip.*

Prior studies (Zwaan et al., 1995a, 1995b; Radvansky et al., 1998; Zwaan & Radvansky, 1998; Kurby & Zacks, 2019; Zacks, Tversky, et al., 2001; Zacks, 2020) consistently emphasise that events involve entities, including both individuals and objects. In the context of non-contiguous events, the 'people' aspect was often consistent across the discontinuity. This was notably evident in chained events, where qualitative observations highlighted prevalent individual interactions during these occurrences, underscoring their strong social dimension.

The 'Topic' aspect was particularly relevant for chained events, as 0.53 of these events involved a consistent topic. In contrast, Simultaneous (0.20), Interdigitated (0.13), and Interrupted (0.11) events had proportions below 0. 20.

The qualitative analysis indicated that participants often did not clearly communicate a topic in their responses. This was seen mainly in activities involving watching, listening, or conversations, where it remains unclear whether these interactions revolved around a single or multiple topics. For example,

Interrupted — *I was watching Netflix when I got interrupted by a noise from another room, so I had to go check it before continuing the Netflix show.*

Simultaneous — *I was exercising in the gym alone while listening to music from a playlist on Spotify.*

Interdigitated — *I was eating dinner with my friend [REDACTED] at home while talking with my mother on the phone.*

In contrast, chained events consistently tended to feature a clearly defined, predetermined topic, such as studying for a specific subject or engaging in extended work-related email exchanges as can be seen in the following examples,

> *I did economics quiz and got scores every week during a semester before I entered the university.*

> *I worked alone on my biology essay throughout the week in my bedroom, doing around a hundred words a day.*

The fact that chained events tended to be unified by an underlying topic highlights the thematic coherence within events that experience extended interruptions. Topic coherence appears to act as a connecting element. This observation aligns with proposals by Linton (1986) and Conway (1992, 1996) that thematic considerations often take precedence over temporal aspects in structuring memory. A similar perspective is endorsed by Radvansky and Cols (1998), who assert that the 'theme' serves as an integral component for information integration within the situation model.

Conversely, for interdigitated, simultaneous, and interrupted events, it was often unclear whether their components reflected a shared topic. This may reflect that these events are bound more by external factors such as people and place, rather than on topic, which may be more connected to participant agency. This likely arises from the topic dimension's ability to swiftly shift and depend on intrinsic motivations such as curiosity, internal interest, and enjoyment (Ryan & Deci, 2000). Employing methodologies that explicitly inquire about the 'topic' aspect would benefit future studies. Such methods enable the assessment of the topic's consistency amidst event transitions or changes. This approach aids in capturing and understanding whether the topic remains constant or undergoes shifts across events.

The 'goal' aspect was consistent in 0.78 of chained events, followed by interrupted (0.58), interdigitated (0.48), and simultaneous (0.40) events. Participants' examples clearly show how chained events were aiming for specific objectives.

Last week, I had a week of homework tutoring with my younger brother in a WeChat video chat.

Last week I had a long email conversation with my subject professors about some problems with my subject.

I was working with my dad on the garden throughout the last week to build a veggie patch.

On the other hand, simultaneous events had less consistency in goal compared to other non-contiguous events. Examples provided by participants illustrated that some simultaneous events were driven by needs (e.g., eating, drinking) or situations where the goal was not consciously perceived (e.g., habits or routines). See some examples below:

I was drinking water while writing my assignments alone in my bed in the evening.

I was walking to my tram stop this morning alone while listening to Lana del Rey on Spotify.

The 'goal' aspect was particularly associated with binding chained events, although it wasn't the sole type of event (see Figure 3). This aligns with prior research indicating that daily life is inherently structured by goals, reflecting the goal-directed nature of human behaviour (Zwaan & Radvansky, 1998; Zacks, Tversky, et al., 2001). The examples provided by participants in our analysis further support this observation, revealing a deliberate intention in their chained events to achieve specific objectives. This perspective is in line with the views of Barsalou (1988), Travis (1997), Radvansky et al. (1998), and Zwaan & Radvansky (1998).

Notably, in the context of chained events, our findings indicate that attaining a goal appears to tie together various events into a cohesive whole, similar aspect observer in Zwaan and Radvansky's (1998) study, who found that narrated events achieve coherence through the pursuit of objectives and plans by the protagonists (Radvansky et al., 1998).

Conclusion

In this study, our primary objective was to investigate how specific elements of events, such as place, people, topics, activities, and goals, can serve as connectors for non-contiguous events in individuals' everyday experiences. Activity and place were, in general, the most associated aspects across non-contiguous events, highlighting their roles in event unification. However, in chained events, place became far less relevant, and the importance of people and goals emerged.

Chained events exhibited a notable emphasis on the 'people' aspect and actively participated in goal-oriented activities, thus underscoring intentional objectives. In contrast, interrupted, simultaneous, and interdigitated events showed a diminished relationship with the 'people' aspect and a reduced focus on achievement orientation, suggesting a potential association with alternative aspects, such as places and activities.

Furthermore, the 'topic' aspect emerged as a critical differentiator among event types. As supported by previous research, chained events consistently exhibited well-defined thematic coherence compared to other categories, highlighting thematic considerations over temporal aspects in event cognition.

In summary, while 'activity' and 'place' aspects consistently tie most event types, they demonstrate relatively lower consistency in 'chained' events. Conversely, 'goal,' 'people,' and 'topic' aspects exhibit higher relevance and association with 'chained' events than other event types.

This study's outcomes underscore the importance of investigating the structures and attributes of non-contiguous events, offering a vantage point for comprehending events within daily life. By delving into the intrinsic characteristics of each event category, we can better understand how certain aspects actively shape and sustain coherence despite inherent discontinuity.

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