

Objects and Events in Context

Giancarlo Guizzardi¹

Conceptual and Cognitive Modeling Research Group (CORE),
Free University of Bozen-Bolzano, Bolzano, Italy
{giancarlo.guizzardi}@unibz.it

Keywords: events, objects, context, conceptual modeling, ontology.

1 Introduction

“Smiles, walks, dances, weddings, explosions, hiccups, hand-waves, arrivals and departures, births and deaths, thunder and lightning: the variety of the world seems to lie not only in the assortment of its ordinary citizens... but also in the sort of things that happen to or are performed by them” [3]. This variety is also evident in our conceptualizations of reality, with, on one hand, “processes”, “activities”, “tasks”, “events”, “occurrences”, “incidents” unfolding in time, and, on the other hand, “objects”, “actors” and “resources” persisting through time, possibly changing in a qualitative way while maintaining their identity.

The distinction between these categories is commonplace in philosophical literature, with the former broadly referred to as “events” (or *perdurants*) and the latter broadly referred to as “objects” (or *endurants*) [3,8]. In this spirit, I here use the term “event” broadly, including references to atomic transitions, complex processes, and even “stative occurrences” (e.g., “Mary sitting in a bench for an hour”) [6]. Analogously, I use the term “object” to refer to independent entities or *substantials* (e.g., you and me, Italy, the moon, John’s car), as well as parasitic “object-like” entities such as *qualities* (e.g., the objectified color of that rose; Sofia’s beauty), *dispositions* (e.g., Matteo’s capacity of speaking Portuguese), and *relationships* (e.g., the marriage of John and Mary, Linda’s presidential mandate) [8,11,6].

In existing modeling frameworks in computer science and related areas, the distinction between *behavioral elements* and *structural elements* (“how” versus “what”) is often invoked to account for the different nature of elements belonging to these two broad ontological categories [16,12]. Accordingly, different modeling disciplines have been established to deal with behavioral and structural modeling, each of which with a different focus. For example, the business process modeling discipline focuses on the “event-like entities”, and, in contrast, the (structural) conceptual modeling discipline focuses on “object-like entities”. In each of these disciplines, entities of one of these ontological categories are first-class citizens, while the other category plays a marginal role (if any). Some notable exceptions in the process discipline are the so-called business artifact-centric approaches [13,14,4], and in the structural conceptual modeling discipline, the event reification approach [15]. In this talk, I argue that there are many

complex domains (e.g., economics and finance, life sciences, defense, advanced engineering) and application areas (e.g., early warning systems, context-aware computing) that require a fuller modeling approach able to capture subtle aspects of objects and events, as of well as the multiple relations involving them [6,9]. Moreover, I argue that such an approach should be based on an in-depth ontological analysis of the nature of these entities. In particular, a notion that deserves the conceptual clarification afforded by such an ontological analysis is that of *context*.

From an object perspective, we seldom interact with these entities *qua-themselves*, but we frequently conceive objects *qua-playing-certain-roles* in given “contexts” [7]. For example, most of our interactions with other human beings and, hence, our conceptualizations of these interactions are thought in terms of *roles* such as parent, employee, student, president, citizen, customer, etc. Analogously, when thinking about, for instance, cars, we think about them as means of transportation, insurable items, work-related resources, product offerings, etc. Moreover, we often conceive these “contexts” as *relational* ones [7,5]: marriages, employments, enrollments, and presidential mandates are themselves concrete “object-like” entities that define a scope in which ordinary objects play complementary roles interacting with each other. Furthermore, these relational entities are constituted by other dependent “object-like” entities (qualities and dispositions) [5] that delimit the properties (e.g., commitments, claims, capacities, powers) that ordinary objects can exhibit in the scope of a given role.

From a behavioral perspective events themselves can also be framed in certain “contexts”. In the most obvious way, this refers to complex events of which more basic events can be part (e.g., “that talk happened in the context of that conference”) [11]. Moreover, “event contexts” can also refer to certain *scenes* [6] (e.g., a lunch meeting in the presence of a number of other happenings in a restaurant), and *situations* [1] (e.g., “Martin Luther King marching while Lyndon Johnson was the president of the U.S.A.”). Finally, there are entities that, while not mereologically related a particular event, do directly influence its manifestation (e.g., “the rain falling during a football match”, “the turbulence during a flight”, “the headache during a meeting”), thus, in a sense, “contextualizing” that event.

In this talk, I also discuss the ontological nature of a number of these entities including substantials, qualities, dispositions, relationships, events, roles, and scenes. This is done in light of the Unified Foundational Ontology (UFO) [8,10,11]. In doing that, I propose some (non-exhaustive) interpretations for the overloaded term “context” when applied to ordinary objects and events dealt with by conceptual modeling. I then discuss the impact of the behavioral vs. structural divide in that field. Finally, I demonstrate how an ontological analysis and conceptual clarification of the nature of these entities can provide the foundations for a fuller conceptual modeling approach, needed for modeling complex domains [9,2].

Acknowledgment

A significant part of the work reported has been jointly conducted with Nicola Guarino, and with João Paulo Almeida. I am indebted to them for many years of fruitful collaboration.

References

1. Almeida, J.P.A., Costa, P.D., Guizzardi, G.: Towards an ontology of scenes and situations. In: 2018 IEEE Conference on Cognitive and Computational Aspects of Situation Management (CogSIMA). pp. 29–35. IEEE (2018)
2. Almeida, J., Guizzardi, G., Almeida, J., Falbo, R.A.: Events in ontology-driven conceptual modeling. Proc. 38th ER (2019)
3. Casati, R., Varzi, A.: Events. In: Zalta, E.N. (ed.) The Stanford Encyclopedia of Philosophy. Metaphysics Research Lab, Stanford University, winter 2016 edn. (2015)
4. Cohn, D., Hull, R.: Business artifacts: A data-centric approach to modeling business operations and processes. IEEE Data Eng. Bull. **32**(3), 3–9 (2009)
5. Guarino, N., Guizzardi, G.: “we need to discuss the relationship”: Revisiting relationships as modeling constructs. In: International Conference on Advanced Information Systems Engineering. pp. 279–294. Springer (2015)
6. Guarino, N., Guizzardi, G.: Relationships and events: towards a general theory of reification and truthmaking. In: Conference of the Italian Association for Artificial Intelligence. pp. 237–249. Springer (2016)
7. Guizzardi, G.: Agent roles, qua individuals and the counting problem. In: International Workshop on Software Engineering for Large-Scale Multi-agent Systems. pp. 143–160. Springer (2005)
8. Guizzardi, G.: Ontological foundations for structural conceptual models. Telematica Instituut / CTIT (2005)
9. Guizzardi, G., Guarino, N., Almeida, J.P.A.: Ontological considerations about the representation of events and endurants in business models. In: International Conference on Business Process Management. pp. 20–36. Springer (2016)
10. Guizzardi, G., Wagner, G., Almeida, J.P.A., Guizzardi, R.S.S.: Towards ontological foundations for conceptual modeling: the Unified Foundational Ontology (UFO) story. Applied ontology **10**(3–4), 259–271 (2015)
11. Guizzardi, G., Wagner, G., Falbo, R.A., Guizzardi, R.S.S., Almeida, J.P.A.: Towards ontological foundations for the conceptual modeling of events. In: 32nd International Conference on Conceptual Modeling (ER). pp. 327–341. Springer (2013)
12. Lankhorst, M.M. (ed.): Enterprise Architecture at Work - Modelling, Communication and Analysis, Fourth Edition. Springer (2017)
13. Meyer, A., Weske, M.: Activity-centric and artifact-centric process model roundtrip. In: Business Process Management Workshops - BPM 2013 International Workshops, Beijing, China, August 26, 2013, Revised Papers. pp. 167–181 (2013)
14. Nigam, A., Caswell, N.S.: Business artifacts: An approach to operational specification. IBM Systems Journal **42**(3), 428–445 (2003)
15. Olivé, A., Raventós, R.: Modeling events as entities in object-oriented conceptual modeling languages. Data Knowl. Eng. **58**(3), 243–262 (2006)
16. Zachman, J.A.: A framework for information systems architecture. IBM Systems Journal **26**(3), 276–292 (1987)