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# Modeling Lifelong Pathway Co-Construction<sup>\*</sup>

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**Abstract.** While personal coach applications are now ubiquitous, personal lifelong pathway co-construction, although present in a wide range of situations (e-learning, healthcare, return to employment, home-care of elders, etc.) is largely overlooked. Modeling generic lifelong pathway co-construction is feasible since these situations share many properties. In this paper, we contribute with a model for the co-construction of lifelong pathways, backed by a literature survey of semantic trajectories, and applicable in a wide range of situations. The model supports the interactions between the two main actors, the advisee and the advisor, in the co-construction, and include the key specific aspects of lifelong pathway: the advisee’s long-term goal, the evaluation of the advisee’s multi-dimensional (educational, professional, financial, medical, etc.) trajectory, the guiding of the advisee via advices that influence the stages of the pathway. To illustrate the importance of this model, we detail its use in a guidance system, to help the advisor’s work in guiding the advisee towards their goal.

**Keywords:** semantic trajectories, life trajectories, lifelong pathway, co-construction

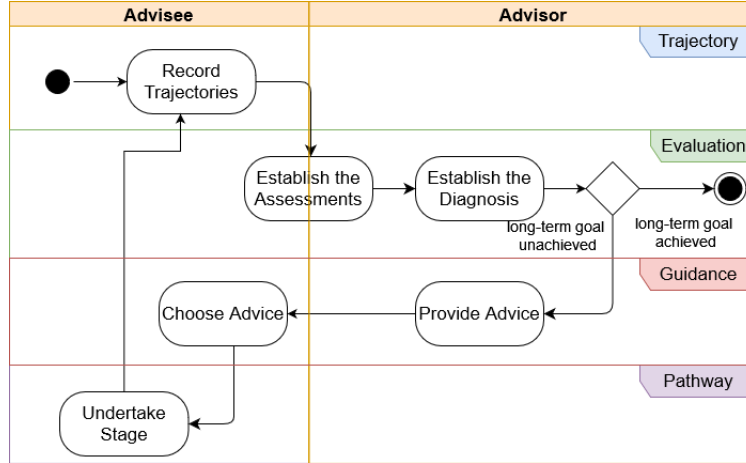
## 1 Introduction

Capturing and modeling the coached evolution of a person according to several possibly independent dimensions is of prime importance in many real life situations. A typical context is that of healthcare, where diagnoses are established before doctors devise patient management and monitor their health over a potentially long period of time. In an e-learning context, the skills and knowledge acquisition states of learners in different courses are modeled and, based on prior evaluations of the learner, a personalized curriculum can be established under the guidance of a teaching staff. In the context of elderly home support, which concerns up to 15 million people aged 60 or more in France, it is expected to help maintaining independence, autonomy, mobility or cognitive abilities by preemptively taking action on these aspects with personalized training programs on the basis of a diagnosis of their medical and social conditions. Finally, in the

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context of job seekers assistance, which concerns 2.06 millions low resources beneficiaries in 2020 in France, one may want to model beneficiaries upon social, professional, medical or educational dimensions. The objective is then to provide the best combined support that improves their social integration or their financial situation based on prior analysis of beneficiaries’ diplomas, past work experiences, social data on housing, family or health condition.



**Fig. 1.** Activity diagram for the co-construction of a lifelong pathway

Common to all these scenarios are: (i) the person whose evolution is under consideration, hereafter called the *advisee*, who has a *long term goal*, (ii) the entity in charge of supporting and helping advisees to reach their objectives, called the *advisor*, and (iii) a *diagnosis* that defines the actual situation of the advisee in terms of different dimensions (e.g., health, financial, professional, education, etc.) and the objectives for the advisee. As depicted in Figure 1, an advisor represents the entity in charge of diagnosing and periodically monitoring the advisee’s progresses based on undertaken actions on all dimensions over time, the latter forming the advisee’s *life trajectory*. In this paper, we are interested in modeling a *lifelong pathway*, i.e. a set of stages made of tailored actions undertaken by an advisee and the underlying co-construction mechanism, participating in the evolution of this advisee’s life trajectory. A life-long pathway involves several entities such as the advisee, the advisor or any other stakeholder involved in its *co-construction*, fulfilling the *objectives* and *long term goal* of the advisee.

As our experience with data of job seekers assistance suggests [Chanson et al., 2021], there is need to support the advisor in the tedious exploration of all combinations of actions to offer to an advisee. This lifelong pathway model will be a corner stone in the development of an intelligent system that helps the advisor in the task of identifying relevant actions. For instance, this system could be a recommender system that would implements the activities in the guidance layer

of Figure 1. While a great deal of work has been done to model trajectories as geographical or semantically enriched entities (see Section 3 below), there is not yet, to the best of our knowledge, a generic model able to represent the richness necessary for the above mentioned situations.

Obviously, while the design of lifelong pathway co-construction applications can be conducted without such a model, formalizing guidelines with a conceptual modeling of the domain will drive further researches, and help the understanding, standardization, reuse and sharing best practices around lifelong pathways co-construction. This is particularly needed by system builders and algorithm designers in the development of complex different interoperable applications. For example, in our use case of job seekers assistance, we noticed that a variety of platforms are used in different regions, sharing only some common concepts and needs. However, the amount of data, technologies and administrative processes make the design of these applications time consuming and their interoperability challenging. Formal guidelines will make these applications easier to develop, maintain and interoperate around common mechanisms like cross-systems pathways recommendation.

As detailed in Section 2, this needs the introduction of different stakeholders, the most important being the advisee and the advisor, the specification of a long term goal, and with the intervene of an intelligent agent to help co-constructing lifelong pathways. This paper proposes the following contributions: (i) an extensive literature survey on trajectory models, (ii) the identification of requirements to set up a proper lifelong pathway model, (iii) a formal definition of the constituting blocs of a lifelong pathway, and (iv) a new model for lifelong pathways.

This paper is organized as follows. Section 2 details the requirements the model should satisfy. These requirements are used in Section 3 as drivers to survey the bibliography around trajectory modeling. Section 4 presents the model, and Section 5 focuses on its use for implementing a guidance system to facilitate the advisor’s work. Finally, Section 6 concludes and draws perspectives.

## 2 Requirements

In this section, we give a set of requirements for the modeling of a system that supports the iterative co-construction of pathways based on an evolutive multi-dimensional and multi-granular profile of an advisee who has a long term goal.

The model should represent:

1. a **human trajectory**: the model should be tailored to the description of the evolution of a person mainly through semantic dimensions not focusing solely on the geographical perspective, and possibly during a long period of time.
2. a **long-term goal**: the pathway construction is driven by a long term goal (e.g., find a job, treat a disease ) that will correspond to milestones in the pathway. These milestones enable the monitoring of the evolution of an advisee, for analytical purpose (e.g., urban study or demographic study ) or

for suggestion purpose (e.g., home support, job finding ), via a diagnosis and can be defined as objectives.

3. **multidimensional** and **multi-granular factors**: the model should enable the comprehension of how the trajectory is impacted by internal and external factors, structured around various dimensions related to the use case (e.g., health, residence or education) and at different granularity levels (e.g., temporal, geographic or business related) to account for the difficulty to precisely characterize the data related to human situations,
4. pathway **co-constructors** and **influencers** : different stakeholders, with different objectives, participate and impact the construction of the pathway. The advisee, who has a long term goal, the advisor (either a person or a group of persons playing the role of a coach with their own objectives) and external stakeholders (services providers, financing institutions, etc.) have to conciliate their objectives and may express constraints that may bend the trajectory.

In the light of these requirements, we conducted a bibliography review of the modeling of trajectories. The result of this survey is reported in the next section.

### 3 Related Works

Modeling trajectories aims at capturing the movement of entities, especially through time and space.

The simplest way of modeling these movements is through the succession of spatio-temporal points arranged in sequences representing different stages of the trajectory of a moving entity. Different types of trajectory models were proposed in the literature, that first differ by their wealth level of description:

1. raw trajectories, as defined by Parent et al. [Parent et al., 2013] as: "a trajectory extracted from a raw movement track and containing only raw data (e.g., speed, direction) for its Begin-End interval referring to the first (Begin) and the last (End) positions of the object for the trajectory".
2. semantic trajectories, defined by Parent et al. [Parent et al., 2013] as: "a trajectory that has been enhanced with annotations and/or one or several complementary segmentation."
3. life trajectories, a concept stemming from sociology [Noël et al., 2017]. A life trajectory is defined by Héléardot [Héléardot, 2006] as: "an interweaving of multiple biographical lines that are more or less autonomous or dependent on each other: the educational path, the relationship to work and employment, family life, social life, health, the residential trajectory, the political itinerary, etc".

As can be seen in Table 1, where works are ordered based on types of trajectories, modeling trajectories started with models adapted to raw, less complex movements, being then enriched giving rise to semantic trajectories. As we will

see below, this category can be subdivided into two types of contributions, depending on the complexity of the concepts represented. The works can also be divided according to their genericity, which we qualify as metamodel in Table 1, this characteristic being important for our model, requiring to model various use cases. Recently in [Noël et al., 2017], more sophisticated models were proposed for life trajectories, that are closer to our objective. Note also that all existing models are adapted for either retrieval (i.e., simply retrieving data described with the model) or analysis (i.e., statistic computations over the represented data), i.e., exploiting past data. In the case of modeling lifelong pathway co-construction, in the presence of a long term goal, our final objective is to support the advisor’s daily work in the co-construction of the pathway. In what follows, we describe in more details trajectory models from each type, each time assessing to which extent they satisfy the requirements of Section 2 for lifelong pathway co-construction.

**Table 1.** Main existing trajectory models based on their complexity (R: Raw trajectory, S: Semantics trajectory, L: Life trajectory), their moving entity (H: Human, A: Animal, G: Generic) and their exploitation (A: Analysis, R: Retrieval, G: Guidance, i.e., using the data to make recommendations)

Model	Complexity	Moving entity	Exploitation	Metamodel
[Spaccapietra et al., 2008]	R	A	R/A	✓
[Güting et al., 2000]	R	G	R/A	✓
[Andrienko et al., 2011]	S	A	R/A	✓
[Baglioni et al., 2008]	S	H	R	✓
[Hu et al., 2013]	S	H/A	R/A	✓
[Fileto et al., 2015]	S	H	R/A	
[Bogorny et al., 2014]	S	H/A	R/A	
[Moreau et al., 2021]	S	H	R/A	
[Mello et al., 2019]	S	H/A	R/A	✓
[Noël et al., 2017]	L	H	R/A	✓
[Thériault et al., 2002]	L	H	R/A	
The present model	L	H	R/A/G	✓

### 3.1 From Geographical Trajectories to Life Trajectories

**Raw Trajectories** The seminal proposal of Spaccapietra and al. introduced the concept of *stop* (period of activity) and *move* (moving period) to model geographic trajectories. This concept focuses on the spatio-temporal component of trajectories and is used by subsequent proposals [Baglioni et al., 2008, Güting et al., 2000]. Raw trajectories are well-fitted for applications that only consist in locating moving entities or conducting analyses on the spatio-temporal characteristics of a trajectory. However, most analysis applications require a certain semantic complexity but also a genericity allowing to answer different use cases. This leads to

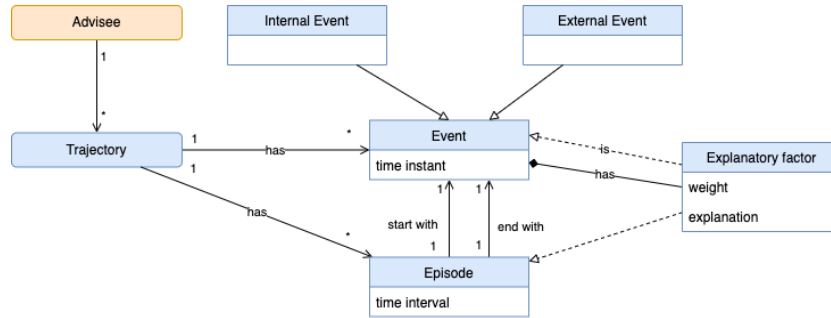
introduce more generic models and then models allowing a semantic enhancement defined by [Parent et al., 2013] as an *annotation* which is an additional data attached to the trajectory or to its sub-parts. These models therefore suffer from expressiveness mainly at the semantic level and do not meet our requirements, but have provided a basis that has been enriched subsequently.

**Semantically Enriched Trajectories** The need to annotate trajectory segments and to model points of interest led to the introduction of new models [Andrienko et al., 2011, Hu et al., 2013]. In particular, Hu et al. [Hu et al., 2013] bring genericity with new formalisms and adapt to more applications by the level of abstraction they propose. Other more recent models propose an annotation of the trajectories, in particular by the annotation of POI, for example by means of transportation of an individual, an hotel opening hours, or the means of transportation of a trip. However, although these models meet our needs of genericity or the semantic dimension that is missing in raw trajectories, they do not satisfy our requirement of multidimensional or multi-granular factors.

**Multidimensional and Multi-Granular Models** More semantic is introduced with multidimensionality [Bogorny et al., 2014], where a semantic trajectory is composed of sub-trajectories, each covering a specific dimension of interest, and each characterized by a specific goal. However, although this model allows a multidimensional representation, it remains centered on the modeling of trajectories of moving objects and is not adapted to the modeling of non-geographical trajectories. Indeed, any sub-trajectory is a composition of geometry, and the concepts used are those of the movement in geographical space (such as speed, acceleration). It does not include the notion of multi-granularity either, where a specific trajectory can be hierarchically composed of different nested segments [Fileto et al., 2015]. Other models include the notion of multidimensional representation to trajectory modeling [Mello et al., 2019, Moreau et al., 2021] with the added ability to consider different levels of granularity. However, none of these models propose a modeling of the actors involved and only models geographical trajectories.

**Life Trajectories** Models in this category represent a type of trajectory centered on the personal life of an individual, going beyond the geographical dimension at the core of other models. Modeling life trajectories was initiated by Marius Thériault et al. [Thériault et al., 2002] to analyze professional, family and residential trajectories. Those dimensions are modeled by the concepts of *episodes*, a set of attributes that remain unchanged over a period of time, and *events* which alternate these attributes and serve as a transition between episodes. However, this model cannot be extended to models of trajectories for other use cases requiring other dimensions, attributes and events than those they initially proposed.

Noël et al. [Noël et al., 2017] extend the model of [Thériault et al., 2002], making it more generic, adding the concept of explanatory factor to enrich



**Fig. 2.** Noël’s Life Trajectory Model [Noël et al., 2017]

events, giving it the possibility to model different use cases. This allows to observe different points of view, representing different angles of analysis on an individual’s life. Their model is presented in Figure 2 and aligned with our notations, the individual at the center of the trajectory being qualified here as advisee. In the end, Noël et al.’s model meets most of our requirements by proposing a generic semantic model, allowing for multidimensional representation and different levels of granularity. On the other hand, the model does account for co-construction with various actors and does not include the concept of long-term goal.

### 3.2 The Need for a Model of Lifelong Pathways

Table 2 provides a summary of the aforementioned models based on the requirements of Section 2. We identify 3 main types of contributions. First, models tailored for a specific modeling need related to a particular use case, such as the analysis of bird trajectories [Spaccapietra et al., 2008]. Second, models that enrich trajectories with semantic related to point of interest of moving entity. These models provides either multidimensional representation [Bogorny et al., 2014], multi-granularity [Fileto et al., 2015] or both [Mello et al., 2019, Moreau et al., 2021]. Finally, the third category of models corresponds to more expressive models that can better capture trajectories not only related to geographical entities such as point of interest and moving entities, but more generally to any social dimension representation space related to a person as in [Thériault et al., 2002] and extended by [Noël et al., 2017].

These models, however, are not expressive enough to represent a lifelong pathway. Notably, the concepts of short-term objectives and long-term goals are missing, even though a very straightforward notion of objective is introduced as a simple label on a segment in [Bogorny et al., 2014] (hence the bracketed tick in Table 2). Models of life trajectory [Noël et al., 2017, Thériault et al., 2002] are natural candidates for the elaboration of our lifelong pathway model. They indeed have the potential to represent the multiple dimensions and the different granularities needed to describe human activity. However, these models

**Table 2.** Lifelong pathway requirements compliance. Stakeholders denotes advisors and advisee roles, co-constructors and influencers.

Model	Human trajectory	Long-term goal	Multi-dimensional	Multi-granularity	Multi-stakeholder
[Spaccapietra et al., 2008]					
[Güting et al., 2000]	✓				
[Andrienko et al., 2011]					
[Baglioni et al., 2008]					
[Hu et al., 2013]					
[Fileto et al., 2015]				✓	
[Bogorny et al., 2014]		(✓)	✓		
[Moreau et al., 2021]			✓	✓	
[Mello et al., 2019]			✓	✓	
[Noël et al., 2017]	✓		✓	✓	
[Thériault et al., 2002]	✓			✓	(✓)
The present model	✓	✓	✓	✓	✓

miss two important aspects of our proposal: (i) the introduction of specific actors and stakeholders influencing the co-construction (a limit form is present in [Thériault et al., 2002] hence the bracketed tick in Table 2), and (ii) the introduction of a concept of evaluation attached to long-term goals that can be derived into short-term objectives. In the case of modeling lifelong pathway co-construction, in the presence of a long term goal, our final objective is to support the advisor’s daily work in the co-construction of the pathway. This is why the pathway model not only should describe the past life trajectory of the advisee, but also include concepts for representing guidance, i.e., the advisors’ work in the co-construction of the potential future trajectory of the advisee. Indeed, not only do we need to model the past and present life of an advisee, but also to envision different future trajectories, embodied in the model under the concept of Advice. Advice represent possible future actions to be undertaken as stages of the advisee’s pathway. The next section details how we extend the model of Noël and al. [Noël et al., 2017] to model lifelong pathways.

## 4 The Lifelong Pathway Model

This section introduces our model of lifelong pathway, first with a functional overview, then detailing the concepts.

### 4.1 Functional Overview

As explained above, we base our lifelong pathway model on that of life trajectory introduced by [Thériault et al., 2002] and completed by [Noël et al., 2017], since this model already covers many of the requirements presented in Section 2, as explained in Section 3.

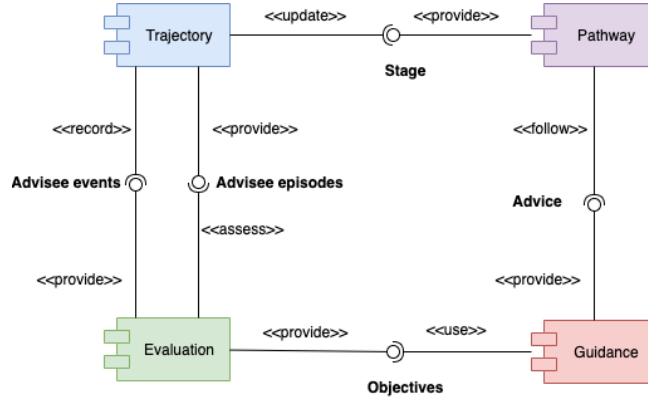


Fig. 3. Component diagram

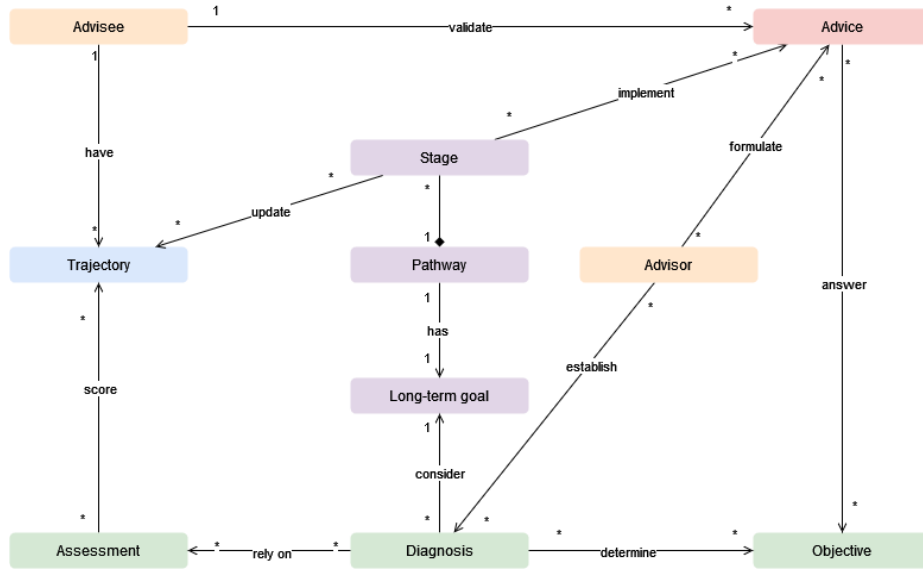
Figure 3 gives a functional overview of our model. It is composed of 4 components representing the four layers of Figure 1. The *Trajectory* component encapsulates the model of Noel et al. [Noël et al., 2017]. This component is responsible for providing and updating the advisee profile, i.e., episodes of multidimensional trajectories. The *Evaluation* component is responsible for the assessment of the advisee by analyzing the advisee’s trajectory. This results in the generation of a set of objectives for the advisee. The *Guidance* component uses the objectives to provide advices to the advisee. Finally the *Pathway* component uses the advice that the advisee agrees with, to build a sequence of stages. These stages impact the advisee’s trajectories, resulting in new episodes and events. Completion of the pathway, when the long term goal is reached, is determined by a final diagnosis.

#### 4.2 Advice as the Essence of Co-Construction

The class diagram of the model is given in Figure 4. Note that the colors are used consistently with Figure 1, 2 and 3. The model includes the two actors, the advisee and the advisor, who interact with the advisee’s trajectories. These trajectories are modeled according to Noel’s model of life trajectories, illustrated in Figure 2. Remember from Figure 1 that the first step of the global co-construction process is to establish an assessment. This assessment is based on the advisee’s trajectories. A diagnosis is then established from which a long term goal and a set of objectives to reach it are defined. Advice to achieve the objectives are formulated by the advisor and validated by the advisee. Once validated, the advice are turned into stages of the lifelong pathway. These stages are undertaken by the advisee, which updates their trajectories.

We now detail the concepts of the 4 components.

*Trajectory* The *trajectory* component is at the core of our lifelong pathway model and is in charge of modeling an advisee profile in terms of multidimensional



**Fig. 4.** The class diagram for lifelong pathway co-construction

trajectories, using the model of [Noël et al., 2017]. As can be seen in Figure 2, a trajectory describes a person from one point of view and the overall trajectory of the person is composed of different trajectories which are themselves composed of episodes. Events serve as transitions between episodes and have associated explanatory factors.

*Evaluation* The *evaluation* component models the assessment of the advisee using their trajectories (e.g, with numerical indicators on the different points of view). For each assessment, a diagnosis is determined by the advisor. Together with the advisee’s long term goal, the diagnosis is used to derive a set of objectives for the advisee. Each stage towards the achievement of the long term goal updates the advisee trajectory upon completion and the latter can be submitted to a new assessment.

*Guidance* The *guidance* component models the advice proposed to the advisee to achieve the objectives determined by the evaluation. This component is the essence of the co-construction, in the sense that advice are formulated by the advisor and validated by the advisee. Note that the Advisor entity models either one expert or a group of experts participating in the formulation of the advice. In this sense, implementing this concept should include contradiction resolution mechanisms. Also, while advice can be determined solely by human experts, it makes sense to automate part of the advisor’s work by implementing a guidance system. For instance, this guidance system could resolve contradictions among experts, or suggest actions to undertake, as explained in Section 5 below.

*Pathway* The *pathway* component models the evolution of the advisee towards their long-term goal. This long term goal is set by a diagnosis established by the advisor after the first assessment of the advisee’s trajectories. A pathway is a sequence of stages, each composed of actions undertaken by the advisee following the advice formulated. Once a stage is closed, it is used to update the trajectories accordingly.

## 5 Automating the Advisor’s Tasks

The model proposed in the previous section is essential to understand the aspects of a co-construction, and particularly the role of the advisor. As explained above, part of the advisor work can be automated. To showcase a practical use of the model, this section describes a guidance system to support the advisor’s work of establishing a diagnosis and formulating advice to the advisee. A preliminary version of such a system, adapted for the aforementioned use case of job seekers assistance, was introduced in one of our previous work [Chanson et al., 2021]. We take advantage of this use case and this preliminary work to illustrate the envisioned guidance system and point out how to cope with the limitations of [Chanson et al., 2021].

### 5.1 The Guidance System

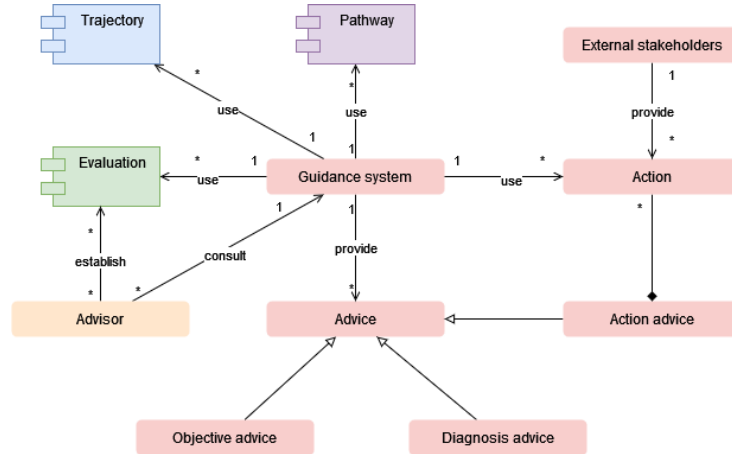


Fig. 5. The generic guidance system

*A Generic Guidance System* The model for a generic guidance system is given in Figure 5. The guidance system model formulates different type of Advice: either future actions to help the advisee in their pathway towards their goal (Action

advice), or elements to help the advisor in the evaluation of the advisee and their pathway (Diagnosis advice or Objective advice). When suggesting Action advice, the system chooses among actions provided by external actors those that best match the objectives set for the advisee. This choice is made considering inputs from the Trajectory, Pathway and Evaluation components: e.g., pathways of former advisees similar to the current advisee, for whom the suggestions are made, or evaluations of former advisees for whom similar diagnoses were made. The same inputs may be used when suggesting Objective or Diagnosis advice: e.g., diagnosis can be established on the basis of diagnoses made for former advisees with similar trajectories and long term goals, or on the basis of undertaken stages failed by the advisee.

*A Preliminary Guidance System for Job Seeker Advisees* A first guidance system was proposed in [Chanson et al., 2021] in the context of job seeker assistance. For this system, only some key concepts necessary to the support of job seekers were identified. The system took the form of a recommender system, suggesting to job seekers (called beneficiaries in [Chanson et al., 2021]) a personal pathway using a large set of actions pertaining to health, social or professional aspects. Technically speaking, [Chanson et al., 2021] addresses the complex problem of recommending several items at once, also known as composite item recommendation. The produced so-called bundles of actions ensure the adequacy of actions with the beneficiary diagnosis (relevance of an action), complementarity between actions (distance between actions) and the feasibility of each action in the context of the beneficiary (cost measure attached to each action). As such, this preliminary work does not encompass all the concepts of the model described in Section 4. More precisely, the concepts used were those of advisee, actions (each action having a cost and each pair of actions a distance), diagnosis (represented by a set of features), pathway (modeled as a sequence of actions), and guidance. This guidance system generated recommendation under the form of a pathway of actions, in a collaborative fashion, based on the diagnoses and pathways of former beneficiaries. The model used in [Chanson et al., 2021] is on many aspects consistent with the one presented here. For instance, consistently with Figure 5 the guidance system of [Chanson et al., 2021] uses the evaluation of the advisee to propose advice picked from the possible actions, based on the pathways and evaluations of former advisees. Propositions rely on the computations of cost for the actions and distance between actions defined in methods of the Action class, and relevance defined in a method of the Advisee class, etc. However, that model mixed different concepts and overlooked some others. For instance, the notions of diagnosis, assessment and objectives were not distinguished, which prevented the definitions of advice based on the objectives determined by different diagnoses. As another example, advisee’s trajectories were defined only coarsely, which prevented to calculate fine-tuned distances between advisees’ profiles.

*Example 1.* Consider an Advisee named Alice, whose long term goal is to find a full time job. Her trajectory shows that she lives in a small city, has a young kid and does not have a driving license. There is a first job offer in the city she

lives in, but for which having a vehicle is necessary, and two jobs offers in a distant city, one which is close to a child care and another which corresponds more to her qualifications. If the notions of diagnosis, assessment and objectives are not distinguished, and trajectories are only coarsely defined, like in [Chanson et al., 2021], only simple likelihoods based on the set of advisees can be expressed to make advice. In this case, the guidance system will suggest e.g., the application for a new degree, which is the most popular advice among former advisees, while other advice like registration to a bus service between the two cities, will be overlooked.

## 5.2 Taking Advantage of the Lifelong Pathway Co-Construction Model

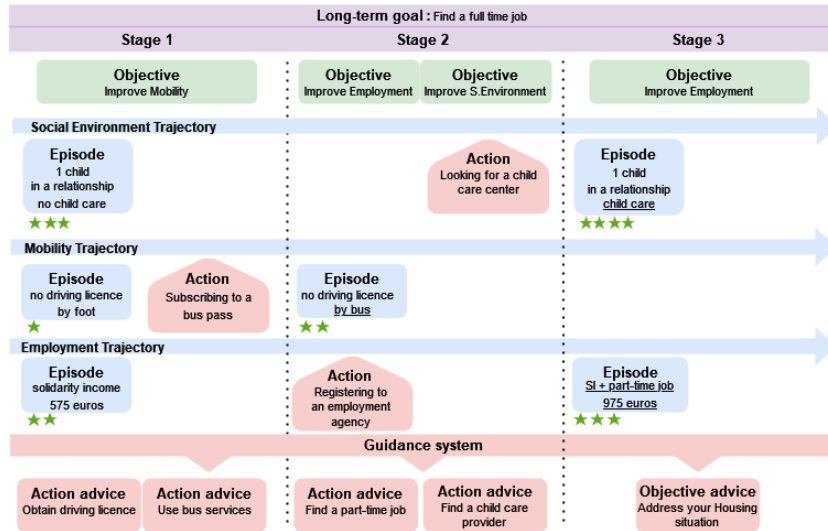
In the job seekers use case, the system of [Chanson et al., 2021] recommends professional projects for the french solidarity income beneficiaries. It primarily predicts the relationship between the evaluation and the advisee’s actions within the observed pathways to recommend complementary actions. As explained above, it does not take into account the advisee’s long-term goal (e.g., being recruited for a precise job) or a finer notion of pathway of an advisee as a sequence of stages. Our lifelong pathway model explicits trajectories, pathways, diagnoses, and objectives attached to a long-term goal for each advisee, allowing to represent the history of what was proposed to each advisee and with what success in relation to their long-term goal. With this model, new guidance scenarios can be considered, leading to more accurate advice.

For example, instead of predicting for each action whether it should be added or not to an advisee’s pathway, simple collaborative filtering techniques could be implemented. Leveraging pathway information, a user-item matrix can be constructed from the advisee-action relationship of the pathways and classical recommender system machinery can be deployed. To allow for direct bundle recommendations, the long-term goal, together with the more specific objectives that follow the evaluation, will help to determine a subset of other advisee pathways to pick relevant actions from. In this case, following the principles of nearest neighbors recommendation, this needs to devise new similarity measures between objectives, trajectories, pathways or long-term goals.

Guidance could also take advantage of the advisee-goal or advisee-diagnosis relationship. In this case, the advisor and the advisee do not directly agree on the actions to be taken but rather (i) on the selection of relevant objectives from a set of objectives that may be very large or (ii) on the definition of a new diagnosis to search for completely new objectives. Since the model now enables a rich description of advisees and actions provided by external stakeholders, determining the relevance of an action to an advisee can rely on more complex similarity measures based on different conceptual spaces representing the actions and pathways, trajectories made of episodes or events, evaluation and assessments. As in any guidance system, actors will only use the system if they trust it. This is the trendy problem of the explainability of any recommendation system [Zhang and Chen, 2020]. One way to enforce trust in the system

is to propose elements of discussion, or examples that justify why an advice was eventually made to an advisee. In this regard, our model provides access to examples (of other advisees and their pathways, trajectories, and long-term goals) or a rich description of actions, episodes, or events in the advisee’s trajectory that could serve as an interpretable space on which a formal explanation can be learned.

*Example 2.* Continuing the scenario of Example 1, illustrated in Figure 6, a guidance system implementing the co-construction model will formulate advice as follows. First, the trajectory of Alice is evaluated. From the assessment made, the system suggests a diagnosis where it appears that Alice mobility situation is critical and should be addressed first. The system can also formulate the objective of improving her mobility situation, and suggest action advice of getting a driving license to apply for the job in the city she lives in. Besides, with a fine description of the advisees’ trajectories, the guidance system can base the advice on the similarity of Alice’s trajectory with those of former advisees and suggest action advice of applying for the job in the distant city, using a bus service between the two cities and the child care of that city. This information stored in Alice’s trajectory could eventually serve as an explanation why she applied for a job in a distant city.



**Fig. 6.** Graphical depiction of Alice’s pathway in Example 2, using the color code of the diagrams. The *pathway* consists of 3 *stages*, with 3 *trajectories* composed of *episodes*, each *assessed* in terms of criticality (green stars). The pathway evolves with the *actions* undertaken following the Guidance System suggestions.

## 6 Conclusion

This paper proposes a better understanding of the concepts and mechanisms involved in the co-construction of lifelong pathways. We contribute with a generic model for the co-construction of lifelong pathways, backed by a literature survey of semantic trajectories. We also describe a guidance system to support the co-construction, leveraging the proposed model.

We are currently working on a generic guidance system implementing the co-construction model. We will experiment it in two contexts for which data are already available to us: the return to employment and the elderly support. As explained in Section 5, one key challenge will be to enforce the confidence that the advisee will have in the guidance system.

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