Spaces of possibilities: a theoretical analysis of mentoring from a regulatory perspective

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A review of the literature on the effectiveness of mentoring reveals a paradox: on the one hand, there is evidence that mentoring can be highly effective. On the other hand, meta-analyses usually only show small to moderate effect sizes, and sometimes even negative effects. To better understand this mentoring paradox, we discuss three fundamental problems in mentoring research. We propose working definitions and theoretical premises to overcome these problems. We apply various systemic concepts to the field of mentoring that might help to resolve the mentoring paradox. We introduce mentees’ actiotope and their interaction with other systems as the unit of analysis, and the regulations for which mentors are responsible for in the context of mentoring as the categories of analysis. To systemize and elaborate on the regulatory dimensions of mentoring, we introduce the nonagonal framework of regulation in mentoring (NFR-M). To facilitate the analysis of ongoing changes caused by mentoring and therefore a dynamic understanding of mentoring, we introduce the concept of spaces of possibilities in mentoring (M-spaces). Finally, we introduce the concepts of the Athena Mentor to explain why mentors can differ so dramatically in the effectiveness of the regulations they are responsible for in the context of mentoring. We conclude by describing how mentoring comparisons based on the NFR-M, mentors’ regulatory insight, regulatory power, and M-spaces can help to resolve the mentoring paradox.

Keywords: mentoring; mentoring paradox; regulation; space of possibilities; actiotope

Introduction: the mentoring paradox

Development—independent of the field (social—emotional, academic, organizational, etc.)—is not an autocatalytic process. In other words, it does not happen by itself. Development requires the cooperation of numerous actors. In addition to the developing individuals themselves, one group of persons has repeatedly come to the fore in research studies: mentors.1–4 Indeed, many developments are hardly conceivable without a personal mentor. Retrospective biographical analyses of eminent persons, for example, provide evidence for the importance of mentors.2,3,5–9 What applies to developing eminence in a talent domain also applies to general learning processes in other contexts, such as school.4,10

The evidence for the importance of mentors was so convincing that Bloom,11 in his famous “2 Sigma Problem,” elevated one-on-one mentoring to the gold standard for instructional methods. He found that an individually mentored student achieved, on average, above the 98th percentile of the control class in which pupils received regular classroom instruction.

Yet, a closer look at the research literature on mentoring unveils a striking contradiction to Bloom’s11 two-sigma promise and, we argue, justifies the term mentoring paradox. The evidence for the effectiveness of mentoring contradicts the results of meta-analyses. At best, the meta-analyses report moderate effect sizes for mentoring.12–16


their meta-analysis, Raposa et al.15 emphasize “the need to remain realistic about the modest impact of these programs as currently implemented” (p. 423). In fact, it is not uncommon to find negative effects of mentoring.17–21 For example, Herrera and Karcher18 explicitly point out that mentoring can cause considerable damage. How can the mentoring paradox be resolved?

Three fundamental problems in resolving the mentoring paradox

The resolution of the mentoring paradox faces three major difficulties. First, there is no generally binding definition of mentoring. We characterize this as the definition problem. Second, the term mentoring can refer to myriad different educational measures and formats, making it impossible to identify structural characteristics that would hold for all mentoring. We term this the mentoring inflation problem. Third, mentoring never occurs in isolation. Instead, it is always combined with other measures and influenced by various factors.22,23 Therefore, mentoring effects are confounded with nonmentoring effects. We term this the methodological holism problem. In the following, we discuss each problem in more detail.

The definition problem

Mentoring dates back to the mythological relationships between Telemachos (son of Odysseus) and the goddess Athena, Mentes (king of the Taphians), and Mentor (son of Alcimus), as described in the first four books of Homer’s Odyssey, known as the Telemachy. Mentes and Mentor acted as advisors and protectors of Telemachos. Athena, who at times was said to have taken the form of the two, supported Mentes and Mentor. In contemporary English usage, the word typically refers to a kind of “trusted counselor or guide.”24 The designation mentee is derived from mentor and indicates the beneficiary of the mentoring activity. Finally, mentoring refers to the service provided by the mentor.

The usage of poetic terms derived from Greek mythology in modern science is not without its problems—in particular as the myth itself is subject to a variety of interpretations. The layers of interpretation and meaning contained within the modern term have been noted; “the general use of the word [mentoring] probably is via later popular romances, in which Mentor played a larger part than he does in Homer.”25 These heterogeneous lexical lineages have likely contributed to the coexistence of competing mentoring definitions within the scientific literature.26 The various definitions of mentoring are best understood as having more of a family resemblance, in the sense set out by Wittgenstein,27 and make it, therefore, difficult to resolve the mentoring paradox.

The mentoring inflation problem

The diversity of the definitions of mentoring in the scientific literature corresponds to the diversity of its implementations and formats in practice. For example, some important differences concern:

- The number of mentors and mentees in a mentoring relationship, from one-on-one to various forms of group mentoring.28–31
- How mentors and mentees find one another; for example, whether there is targeted matching by program coordinators, whether the mentee and mentor can choose their mentoring partner, or whether the mentor and mentee find one another informally in natural settings.16,32–37
- The relationship between mentor(s) and mentee(s), that is, how well they know one another and whether they ever meet in person or only have a long-distance relationship.35,38–44
- The age constellation, ranging from older and more experienced mentors to peer mentoring and to various forms of reversed mentoring in which, for example, juniors act as mentors and seniors as mentees.37,45–48
- The objectives of mentoring, which range from narrowly defined objectives such as mentoring with regard to highly specific groups (e.g., female ex-prisoners or young Canadian immigrants) to mentoring oriented toward organizational interests, from specific personality traits (e.g., performance development) to general personality development concerns.15,19,29,44,47,49–54

The different implementations and formats of mentoring make it impossible to identify structural features that would be common to all mentoring. This, in turn, makes it difficult to compare their effectiveness and therefore to resolve the mentoring paradox.
### The methodological holism problem

Mentoring meta-analyses calculate the effect sizes of mentoring programs. \(^{12-16}\) The aim is to break down analytically the effects of different aspects of mentoring, for example, considering the influence on mentoring success of the duration of the mentoring, the frequency of contacts between the mentor and mentee, or the quality of their relationship. In other words, traditional analyses of mentoring are component-dominant, \(^{55}\) as they are based on the assumption that mentoring success can be predicted from relevant variables. \(^{56}\) In our view, this falls far short of adequately capturing the complexity of mentoring and therefore makes it difficult to resolve the mentoring paradox.

The success of mentoring depends on many highly interconnected, mutually interacting factors, certainly not just on the mentor and mentee. These factors also encompass many nonmentoring factors in a strict sense, but which nevertheless have a substantial impact on the mentoring success. \(^{22,23}\) For example, the very same mentoring program might be highly effective at a well-equipped school, but ineffective in another school. Similarly, a mentoring program might be successful in an organization that supports the mentoring program, but not so in an organization that is less supportive of the program. Mentoring factors and nonmentoring factors are thus flexibly networked (i.e., softly assembled) at any given moment and always depend on the respective context and presence of past mentoring. In other words, the totality of factors that constitute mentoring success does not interact rigidly, but rather in manifold ways, permanently changing and producing complex outcomes. With this in mind, traditional component-dominant analyses of mentoring effectiveness are problematic, and a new systemic approach \(^{22}\) might be helpful to resolving the mentoring paradox.

### Working definitions and theoretical premises to resolve the mentoring paradox

The existence of the three problems described above does not mean that it is impossible to examine mentoring in a comparative way or to make comparative statements, and thereby to work toward resolving the mentoring paradox. However, making comparative statements presupposes that (1) the definition, (2) the unit of analysis, and (3) the categories of analysis are broad enough that any specification of mentoring made by researchers, program designers, educators, etc., can be considered a special case of these general stipulations.

In the following, we will, first, introduce working definitions for the terms mentoring, mentoring episodes, and mentoring pathways. These working definitions create a basis of understanding for the types of conceptual analyses we propose when it comes to resolving the mentoring paradox. Second, we will introduce the mentees’ actiopes and their interactions with other systems as the unit of analysis—a unit of analysis broad enough to encompass all relevant aspects of mentoring so far considered in reviews and meta-analyses. Finally, we will introduce regulations for which the mentors are responsible in the context of mentoring as the categories of analysis of mentoring and its effectiveness. Table 1 provides an overview of the three fundamental problems in resolving the mentoring paradox as well as of relevant working definitions and theoretical approaches to resolve this paradox.

### Working definitions of mentoring, mentoring episodes, and mentoring pathways

We propose a working definition of mentoring as the activities of persons in their role as mentors. This definition reflects the dictum by Wittgenstein \(^{27}\) that “the meaning of a word is its use in the language” (p. 20). This means as long as our readers’ understandings of mentoring do not fall outside this general linguistic understanding, our comparative analyses in resolving the mentoring paradox should be compatible with their individual conceptions of mentoring and the role of the mentor.

We need two further working definitions—for the terms mentoring episode and mentoring pathway—that will be useful for analyzing more situational, temporal, and dynamic aspects of mentoring. Following Vendler’s definition of an event, \(^{57}\) we define a mentoring episode as any identifiable segment of time with an identifiable beginning (e.g., the mentor begins a mentoring activity) and an identifiable end (e.g., the mentor ends a mentoring activity). We define a mentoring pathway as a sequence of mentoring episodes leading to a mentoring goal.

### Unit of analysis

The aspects of mentoring considered in reviews and meta-analyses vary greatly. They range from individual personality traits and specific behaviors to dyadic relationships and complex social systems.
Table 1. Overview of fundamental problems in resolving the mentoring paradox as well as necessary working definitions and proposed concepts that might help resolving the mentoring paradox

| Three fundamental problems in resolving the mentoring paradox | Working definitions that are broad enough to help resolve the mentoring paradox | Proposed concepts to allow mentoring programs to be compared with each other |
|-------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| • Definition problem: a generally binding definition of mentoring is missing. | • Mentoring refers to all activities of persons in their role as mentor. | • Unit of analysis: Mentees’ actiotopes and their interactions with other systems. Definition: “An actiotope is the entirety of the individual and the material, social, and informational environment with which this individual interacts” (Ziegler et al., \(^{38}\) p. 3). |
| • Mentoring inflation problem: the term mentoring refers to myriad different pedagogical measures and formats, making it impossible to identify structural characteristics that hold for all mentoring. | • Mentoring episodes refer to any identifiable segment of time with an identifiable beginning (e.g., the mentor begins a mentoring activity) and an identifiable end (e.g., the mentor ends a mentoring activity). | • Categories of analysis: Regulatory dimensions for which mentors are responsible in the context of mentoring, that is, mentors’ monitoring and control activities in pursuit of a mentoring goal (for a more differentiated overview of regulatory dimensions of mentoring, refer to Table 2). Definition: Regulations describe all of a mentor’s monitoring and control activities in pursuit of mentoring goals. |
| • Methodological holism problem: Mentoring never occurs in isolation; it is always combined with other measures and influenced by various factors. Therefore, mentoring effects are confounded with nonmentoring effects. | • Mentoring pathways refer to a sequence of mentoring episodes leading to a mentoring goal. | |

As with the definition of mentoring, our conceptual analyses must remain broad in order to reflect this diversity. Furthermore, it is important to consider that factors constituting mentoring success are not independent from one another but interact in manifold ways. Therefore, we suggest viewing mentees’ actiotopes and their interactions with other systems as the unit of analysis. In their systemic actiotope model, Ziegler et al.\(^{38}\) defined an actiotope as “the entirety of the individual and the material, social, and informational environments with which this individual interacts” (p. 3). Thus, an actiotope encompasses the individual and her personal environment as well as systemic interactions between the individual and environmental aspects.\(^{a}\) In the case of mentoring, the actiotope includes a person along with her goals, action repertoire, and subjective action space; and her environment, both related and unrelated to mentoring. Therefore, the actiotope explicitly includes all interactions of mentees with mentors but is not limited to these interactions.

\(^{a}\)At the center of the actiotope model are actions. Developments (in mentoring but also outside this area) are interpreted as a gradual expansion of an action repertoire. The action repertoire includes all actions that a person can perform at a certain point in his or her development. In subjective action space, potential actions are mapped that could lead to the achievement of the goals activated at that moment in the environment and also accessible at that moment. For example, a mentee may have sufficient competence to study a subject related to science, technology, engineering, and mathematics (STEM) in her action repertoire; however, owing to her environment, which considers STEM to be unfeminine, she may—within her subjective action space—lack the self-confidence to do so. In the actiotope model, a large number of systemic interactions are postulated. Of central importance is the idea of the coevolution of the components of the actiotope (i.e., among the action repertoire, goals, subjective action space, and environment). Once a learning step has been mastered (e.g., new competencies in STEM have been acquired), the expanded action repertoire must be mapped in the subjective action space (e.g., increasing confidence in one’s own STEM abilities). A new goal must then be set that relates to the learning step that now follows (e.g., choosing a STEM course at school). Finally, the learning environment must be designed in such a way that this next learning step is possible (e.g., via adequate support provided by a mentor and parents). For more information about the model, refer to Ziegler.\(^{140}\)
Categories of analysis
A comparative consideration of mentoring and its effectiveness—and thus the resolution of the mentoring paradox—requires categories of analysis. To this end, we propose that analyses in this article focus on the regulations for which the mentors are responsible in the context of mentoring. This is because the act of mentoring aims to regulate processes in order to achieve certain mentoring goals.

The term regulation is used across scientific disciplines, whereby the core meaning is quite constant. Nevertheless, no common definition exists. Consequently, our working definition must meet two criteria. First, it must be suitable for the topic of mentoring; and second, it must be as similar as possible to the prototypical definition of regulation in the behavioral sciences. Following Ziegler and Stoeger, we now propose the following working definition of regulation: In mentoring, the concept of regulation describes all of a mentor's monitoring and control activities in pursuit of mentoring goals. As this definition does not specify any content, it requires further elaboration. To this end, we will introduce the nonagonal framework of regulation in mentoring (NFR-M). Before doing so, we will briefly recap why we think applying systemic concepts—such as the actiotope and regulations—to the field of mentoring can be helpful to resolve the mentoring paradox.

Applying systemic concepts to the field of mentoring
One important reason for choosing mentees’ actiotopes as the unit of analysis and regulations as categories of analysis lies in the fact that both make it possible to take a systemic and therefore more holistic approach to resolving the mentoring paradox. Mentoring is an educational method that has evolved from practical experience. This circumstance brings with it strengths, but also risks. One risk worth mentioning is mentoring's development within the context of natural language. No natural language in the world has developed a vocabulary for systemic causality. Rather, natural languages assume direct causality, that is, simple cause–effect relationships. By contrast, systemic approaches assume circular causality. Entities, resources, and processes are examined in their interconnectedness and in how they influence one another in loops. With this in mind, we advise that the field apply systemic concepts to the subject of mentoring because such scientific concepts are well suited to addressing the aforementioned shortcomings inherent in terminologies derived from everyday language. For this reason, we focus on mentees' actiotopes and their interaction with other systems as unit of analysis, and on regulations of which the mentors can be responsible in the context of mentoring.

In the following, we will, first, systemize and elaborate on the regulatory dimensions of mentoring by introducing the NFR-M. The specifications in this framework help to clarify the regulations for which mentors can be responsible in the context of mentoring, that is, their monitoring and control activities in pursuit of mentoring goals. Applying systemic concepts to the field of mentoring does not only enable a more holistic approach but also a dynamic understanding of mentoring. As mentoring activities induce changes in mentees’ actiotopes, so, too, do the requirements on and the role of their mentors change at various levels. To facilitate the analysis of these dynamics, we will, second, introduce the concept of spaces of possibilities in mentoring (M-spaces).

Regulatory dimensions of mentoring: the NFR-M
Regulation generally means that a system monitors certain parameters with regard to maintaining certain standards and, if necessary, initiates modifications. This can easily be applied to the work of a mentor. Mentors pursue different goals for their mentees. These goals do not come about of their own accord; if they did, the mentoring would be unnecessary. To achieve these goals, the mentor will make a number of regulations. We will systemize and elaborate on these regulations by introducing the NFR-M.

The NFR-M was developed on the basis of the nonagonal framework of regulation in talent development and represents an adaptation to the subject of mentoring. It is not a model of mentoring, as the complexity of regulation in mentoring (a multimodal, multi-agent, multifaceted, and multiscale phenomenon) is still beyond the theoretical and methodological scope of introducing a model. However, we assert that an important step toward such a model is possible by developing a framework,
such as the NFR-M, in the sense of a “network of linked concepts” (p. 49).67

The NFR-M comprises nine analytical dimensions: (1) regulatory network, (2) control type, (3) regulatory function, (4) regulatory activity, (5) regulatory type, (6) regulatory form, (7) regulatory resources, (8) regulatory side effects, and (9) regulatory externalities. Table 2 gives an overview of the nine regulatory dimensions. The nine dimensions serve to organize the current knowledge on mentoring with regard to regulatory processes and to apply this knowledge in planning, monitoring, and controlling mentoring.

In the following, we will introduce the nine analytical dimensions. This form of overview is purely propaedeutic in nature. The NFR-M is by no means a sequential model where one step after the other is to be worked through. Rather, it is committed to the idea of circular causality, that is, to the proposition that the dimensions always interlock and cannot be separated. Thus, in practice, because of the uniqueness of each mentoring episode, good mentors will opportunistically consider the nine dimensions until they can organically develop a plausible mentoring pathway, adapted to the situational circumstances. Ideally, the resulting pathway will include all nine dimensions.

**Regulatory network.** Mentoring can address disparate goals and groups of mentees such as talents, new employees in a company, or at-risk youths.5,15,47,49,68,69 Whatever the goals or groups may be, they require a myriad of regulations at different levels. The regulations range from regulations of physiological processes (e.g., nutrition of athletic talents or recovery phases after strenuous training) to regulations that extend beyond the mentee’s actiotope (e.g., writing recommendations for the mentee, and providing job interviews).

For mentoring to be successful, it is desirable for mentors to have a good understanding of their mentees’ actiotores, which include the mentee, their environment, and their interactions with their environment.64,70,71 Mentors need to have an overview of which relevant processes are already regulated with regard to the mentoring objectives and how well these processes are orchestrated. In other words, they need to know which activities within the actiotope of their mentees form a functional regulatory network of processes to reach the mentoring objectives. Research on talent mentoring, for example, shows that with mentees’ increasing expertise, more and more aspects of their lives are subordinated to the goal of talent development. In extreme cases, almost all activities within the actiotope are affected and form a highly functional regulatory network of processes intended to increase skill level.6,72,73 For example, mentees on their way to excellence in a talent domain reduce leisure activities to have more time for talent development, plan their sleep and nutrition routines to optimally support their talent development, and focus on social interactions with individuals who are also interested in their talent domain.

To analyze whether the activities within the actiotope of their mentees form a functional regulatory network of processes suitable to reach the mentoring objectives, mentors not only need to consider the mentee herself but also different agents within her environment. The same process can be the subject of several regulations controlled by people with different perspectives and expectations.36,74,75 In our example above, a mentor regulates her talent development herself; but also the mentor, parents, teachers, and friends are involved in this process and might differently influence the mentoring goal of talent development. For example, a mentor might support talent development by suggesting interesting reading material, whereas the mentee’s parents may have very different ideas about how the mentee should spend her leisure time.

This example shows that the regulatory processes within a regulatory network in mentoring can have different relations. The NFR-M differentiates five relations between regulatory processes. The first possible relation is neutral relationship. This means two or more regulatory processes appear unrelated. However, this is more a theoretical possibility, as regulatory processes in mentoring will always affect one another. If two or more regulatory processes reinforce one another in their effect on reaching a mentoring objective, they constitute a cooperative relationship. In our example of talent mentoring in an academic domain, a cooperative relationship between regulatory processes would exist if both a mentor and a teacher encourage a mentee to spend the afternoon studying. If two or more regulatory processes impair one another, they constitute a competitive relationship. In our example of talent mentoring a mentor who wants the mentee to study and
Table 2. Regulatory dimensions and spaces of possibilities in mentoring

Overview of regulatory dimensions of mentoring that enable a holistic assessment of mentoring

Regulatory network: Regulatory network in mentoring is the entirety of relevant processes that are regulated and orchestrated to reach a mentoring objective.

The NFR-M differentiates five relations that the regulatory processes within a regulatory network in mentoring can have:

1. Neutral relations: regulatory processes do not influence one another.
2. Cooperative relations: regulatory processes reinforce one another in reaching a mentoring objective.
3. Competitive relations: regulatory processes impair one another.
4. Hybrid relations: regulatory processes both reinforce and impair one another.
5. Panarchic relations: regulatory processes are jointly directed toward reaching a mentoring objective and are perfectly synchronized and aligned with one another.

Control type: The control type refers to the person who is responsible for regulating the processes that will lead to a mentoring objective.

The NFR-M differentiates three different control types:

1. External control type: The mentor regulates by supervising, instructions, or feedback.
2. Internal-automated control type: The mentee regulates her actions as cued by environmental stimuli, largely unaccompanied by conscious reflection.
3. Internal-controlled control type: The mentee regulates her actions in a conscious way by reflecting on relevant processes.

Regulatory function: The regulatory function or objective of mentoring can be distinguished by the intention to either maintain an existing state (homeostasis) or to achieve certain states over time (homeorhesis).

Regulatory activity: The NFR-M distinguishes three different kinds of regulatory activities in mentoring:

1. Detective activities of the mentor serve to obtain information on the status and implementation of regulations.
2. Corrective activities include all activities of a mentor that aim at homeostasis or homeorhesis.
3. Preventive activities serve to increase mentees' action repertoires, by providing them with additional possible actions that might be needed in the future. While corrective activities are generated with respect to existing goals, preventive activities are generated with respect to future goals that are not yet present.

Regulatory type: The term regulatory type in mentoring deals with the question of when a regulation is initiated. The initiation of regulatory activities can be premediated or determined via feedback.

1. A regulatory activity qualifies as premediated if it is carried out independently of detective activities.
2. A feedback-determined regulation occurs as a reaction to certain conditions in the mentoring process that must be detected.

Regulatory form: The term regulatory form refers to a mentor's plan of action in mentoring. It can be either fixed, and rather stable over mentoring sessions, or flexible, and varying from mentoring session to mentoring session, with the mentee having a voice.

Regulatory resource: Successful mentoring requires a variety of different resources to regulate mentoring episodes.

1. Educational resources within the mentee are termed learning capital. Five forms are differentiated: organismic, telic, actional, episodic, and attentional learning capital.
2. Educational resources in the part of the actiotope that is outside the mentee (i.e., her environment) are termed educational capital. Five forms are differentiated: economic, social, cultural, infrastructural, and didactic educational capital.

Regulatory side effects: Regulatory side effects refer to consequences within a mentee's actiotope that arise from regulatory activities.

The NFR-M differentiates seven regulatory side effects:

1. The consequences of regulatory activities would be neutral if a mentee's actiotope would revert to its initial state after the pursuit of a mentoring goal. However, this is only a theoretical possibility.
2. Synergetic side effects occur if the regulation of a process positively influences the process and subsequent processes.
3. Destructive side effects occur if the regulation of one process impairs that process and subsequent processes.
4. A catalytic side effect occurs when the regulation of one process drives another process, while the first process remains unchanged.
5. An exploitative side effect occurs if regulatory processes benefit one party while being detrimental to another party.
6. An allostatic side effect occurs when one regulatory process remains unchanged while it damages another.

Continued
Table 2. Continued

| Regulatory externalities: Systemic effects of mentoring not only occur within a mentee's actiotope (regulatory side effects) but also outside a mentee's actiotope. Effects outside a mentee's actiotope are termed regulatory externalities. Regulatory externalities can have three types of repercussions on a mentee's actiotope. |
|---|
| 1. Neutral externalities leave a mentee's actiotope unchanged with regard to mentoring goals. |
| 2. Iatrogenic externalities have a negative effect on the pursuance of mentoring goals. |
| 3. Autocatalytic externalities have a positive effect on the pursuance of mentoring goals. |

Overview of spaces of possibilities in mentoring (M-Spaces) that enable a dynamic assessment of mentoring

Spaces of possibilities: A dynamic system consists of an abstract phase space, a space of possibilities. Its coordinates describe the state of the dynamic system at any given moment.

Mentoring spaces (M-spaces): Spaces of possibilities in mentoring are referred to as mentoring spaces (M-spaces). Mentoring pathways can be mapped in an M-space. Each state relevant in mentoring corresponds to a certain point in a given M-space. M-spaces can also contain mentoring pathways that may or may not be realized in the future and therefore enable a dynamic view of mentoring.

There are three types of M-spaces that are of particular interest in mentoring:

1. Nomological M-spaces contain all states of a mentee's actiotope that are possible in reality.
2. Epistemic M-spaces contain all states of a mentee's actiotope that a mentor can conceive or mentally construct.
3. Deontic M-spaces describe the preferred or desired states of a mentee's actiotope. They are usually constructed on the basis of norms, wishes, or objectives.

a mentee's friend who wants to go shopping with the mentee instead would constitute a competitive relationship among regulatory processes. If the effects among regulatory processes are mixed, that is, they are neither cooperative nor competitive, they constitute a hybrid relationship. In our example of talent mentoring, a mentor who wants the mentee to study in the afternoon and a mentee's friend who visits the mentee to study with her would constitute a hybrid relationship of regulatory processes—if the shared afternoon study time turns out to have been unproductive and thus not helpful in supporting the objective of talent development. Ideally, if all regulatory processes within a regulatory network are directed toward reaching a mentoring objective and thus perfectly synchronized and aligned with one another, they constitute a panarchic relationship. In our example of talent mentoring a panarchic relationship among regulatory processes would be constituted by a mentor, a mentee, her parents, teachers, and friends, etc., all advocating the same way forward for the mentees. In this case, the mentee and all other stakeholders would want the mentee to spend the afternoon studying, at a quiet workplace. The mentee's younger siblings would know that they are only allowed to listen to music with headphones while the mentee is studying, etc.

After mentors have gained an overview of the regulatory networks, that is, the relevant processes that are already regulated and orchestrated to reach a mentoring objective, they must also decide at some point which further processes should possibly be regulated with regard to the mentoring objectives.

Control type. Once there is agreement about the processes within a mentee's actiotope that are to be regulated, the question arises as to which person will be responsible for regulation. For example, some mentors play an instrumental role and make overt suggestions about how best to reach a mentoring objective. However, it is equally possible that mentors take a more hands-off approach, empowering their mentees to take an active role and clearly articulate their needs in mentoring. More experienced mentees in particular might question the regulatory activities of their mentors. Research indicates that advanced mentees frequently contact other mentors, or increasingly develop an independent profile and style of their own.

In the NFR-M, two basic control types are distinguished. In the case of (a) external control, the mentor regulates actiotope by supervising and instructing the mentee and giving her feedback. However, the mentee can also regulate, whereby two internal control types are distinguished. Following dual theories of information processing and decision making, we distinguish an (b-1) internal-automated control type and (b-2) an internal-controlled control type. We briefly illustrate each control type by way of a simple example.

Various mentoring programs have been implemented to help people overcome eating...
disorders.\textsuperscript{81–83} The mentee and mentor must clarify which stakeholder will initiate regulatory action. The mentee and mentor might agree that the mentor or another external entity such as parents will take on this responsibility. In this case, the stakeholders have agreed on external control of the mentees’ mentoring-related actiotope development. The mentee might, however, take matters into their own hands. If the mentee does so according to their own feelings of hunger, the control would be internal-automated. If the mentee makes conscious decisions (e.g., following the stipulations of the weight-loss regimen), the control would be internal-controlled.

In practice, mentors will usually combine these control types. The mentor can choose a temporal sequence, whereby different control types can dominate in different phases. For example, the mentor might first regulate by suggesting a fixed diet plan; then the mentee learns to increasingly control her behavior, until finally the mentee has internalized a functional eating behavior.

**Regulatory function.** The regulatory function or objective of mentoring can be distinguished by the intention to either maintain an existing state or to achieve certain novel states over time. The first function concerns *homeostasis*, that is, maintaining structures and processes within stable limits (e.g., self-esteem or physical fitness). There are many examples of mentors striving for homeostatic goals. For example, mentors try to keep mentees’ academic and personal lives balanced by helping them solve educational or personal problems.\textsuperscript{19} More generally, mentors empower young people to deal with the particular developmental features of adolescence.\textsuperscript{16} Since mentors themselves are part of the mentee’s actiotope, the regulatory function of homeostasis also affects the mentor, too. For example, it is often not easy for mentors to maintain their own commitments in a balanced way.\textsuperscript{84}

The second regulatory function is *homeorhesis*, that is, the transformation of states. Homeorhetic changes shape developmental and learning trajectories that lead to specific goals. Examples are a cautious increase in exercise times or in the difficulty of tasks a mentee should work on. Cull\textsuperscript{88} provides a helpful illustration of homeorhetic change in his study on the mentoring of young entrepreneurs. He found that successful mentors followed a homeorhetic trajectory with regard to the mentees’ independence from the mentor. Successful mentoring was characterized by a mentoring style that became progressively less intrusive as the business success of the young entrepreneur increased.

**Regulatory activity.** The NFR-M distinguishes three different regulatory activities: detective activities, corrective activities, and preventive activities. *Detective activities* of the mentor serve to obtain information on the status and implementation of regulations. Mentors engage in detective activities when they, for example, speak to the mentee, observe them, take notes on the mentee, encourage the mentee to self-observe, seek out the feedback of others in relation to the mentee’s progress, investigate additional opportunities for supporting a mentee, etc. Such detective activities can be more or less formalized. For example, in a mentoring program for new science teachers by Shea and Greenwood,\textsuperscript{85} mentors are provided with checklists to help them assess their mentees’ teaching skills and knowledge. *Corrective activities* include all activities that aim at homeostasis or homeorhesis.\textsuperscript{54,86} They include activities as diverse as counseling, instructing, motivating, and providing learning material in order to reach a mentoring goal. *Preventive activities* increase mentees’ action repertoires, by providing them with additional possible actions that they might need as they continue to develop their actiotopes in light of agreed-upon talent development goals.\textsuperscript{37–39} While corrective activities make corrections only with respect to existing goals, preventive activities are generated with respect to future goals that are not yet present. We note one example of a preventive activity. A mentor who is mentoring a PhD student in research psychology in a non-English-speaking country, might suggest to her charge that he take a class on scientific writing in English. She points out to her mentor that, based on her own earlier experience in academic publishing, his scientific writing competencies in English will soon become essential for his career advancement.

**Regulatory type.** The term *regulatory type* in mentoring deals with the question of when a regulation is initiated. Regulations can be pre-mediated or determined via feedback. A regulatory activity qualifies as *premeditated* if it is carried out independently of detective activities. This
A theoretical analysis of mentoring

would be the case if, for example, a mentor and a mentee had set up a plan together at the beginning of the mentoring relationship such that the mentee is required to study at a certain time every afternoon or to follow a certain training routine every day. A feedback-determined regulation, on the other hand, only occurs as a reaction to certain conditions in a mentoring process that must be detected. This would be the case if, for example, the mentor suggests increasing her mentee’s studying times whenever her mentee had not understood a topic.

In addition to the initiation of regulatory activities being premeditated or feedback-determined, the feedback a mentor gives a mentee can also be predetermined or feedback-determined. One must take care to keep track of the multiple meanings of the term “feedback.” For example, we would speak of a predetermined feedback activity if each mentoring meeting were to be opened by the mentor with mandatory feedback on the mentee’s successes and failures with the tasks she had worked on since the last mentoring meeting. We would speak of feedback-controlled feedback activities if, for example, a mentor only intervened in explorative learning phases when learning progress threatened to come to a standstill.

Regulatory form. A mentor must not only decide on the purpose and initiation of regulatory activities (see the previous two sections), she must also decide whether to use a fixed or a flexible plan of action. For example, in a school mentoring program, a mentor can suggest to a mentee to start studying in the afternoon with a 15-min follow-up processing of the first morning school lesson, then a 15-min follow-up processing of the second school lesson, etc. Alternatively, the mentor could suggest that the mentee follow a more flexible routine and vary the order, contents, and length of follow-up processing according to the mentee’s learning needs.

An interesting example of a fixed action plan is Adaptive Mentorship©, where precise actions are specified after certain conditions have arisen. When a mentee reaches a predetermined level (D1), the mentor will always respond with a specific activity A1. D2 is always followed by A2, and so on. Other examples of fixed action plans include fixed training schedules, fixed meal plans for athletes, or strictly followed curricula.

Regulatory resources. Studies show that successful mentoring requires a variety of different resources to regulate mentoring episodes. In various publications, we have proposed an exhaustive classification of these resources. Educational and learning capital describe the endogenous resources (i.e., in the person or, in the present context, the mentee) and the exogenous resources (i.e., in the part of the actiotope that is outside the person or, in the present context, outside the mentee) that are relevant for regulating mentoring episodes. There are five forms of educational capital: economic, social, cultural, infrastructural, and didactic; and there are five forms of learning capital: organismic, telic, actional, episodic, and attentional.

Mentors can combine several types of capital to regulate a mentoring episode. For example, a mentor can give a mentee educationally adequate feedback after failure, thus making use of didactic educational capital. The mentor can bring the mentee together with other motivated mentees (cultural and social education capital) in a carefully designed (didactic education capital) learning environment (infrastructural education capital) to facilitate positive learning experiences (episodic learning capital), thereby improving the mentee’s motivation (telic learning capital).

Regulatory side effects. The pursuit of mentoring goals has a variety of impacts on the mentee’s actiotope, which is why a holistic perspective has proven particularly useful. Regulatory side effects refer to consequences within a mentee’s actiotope that arise from regulatory activities. According to the principle of circular causality, such side effects are unavoidable because in an actiotope all processes and resources are interrelated and influence one another in complex feedback loops. Ideally, the processes and resources will eventually return to their desired homeostatic or homeorhetic states and will again synchronize with mentoring goals. However, since this need not necessarily be the case, it is useful to systemize the various side effects of regulatory activities that can emerge inside a mentee’s actiotope.
The consequences of a regulation would be neutral if a mentee’s actiotope would revert to its initial state after the pursuit of a mentoring goal. However, this is only a theoretical possibility, because resources are needed to return the actiotope to its initial state. These resources can be replenished, but doing so requires further regulatory processes, which, in turn, consume resources themselves.

Synergetic side effects occur when the regulation of a process positively influences the process and subsequent processes. In talent mentoring, for example, increasing a mentee’s training time (i.e., attentional learning capital) can lead to improved performance (i.e., actional learning capital), which, in turn, can have a positive influence on the mentee’s motivation (i.e., telic learning capital). Achieving such synergetic side effects is an essential goal of regulatory processes in mentoring. The opposite of synergetic side effects are destructive side effects, where the regulation of one process impairs that process and subsequent processes. In our example of talent mentoring, reducing a mentee’s training time (i.e., attentional learning capital) could lead to a loss of performance (i.e., actional learning capital), which, in turn, could have a negative impact on motivation (i.e., telic learning capital).

A catalytic side effect occurs when the regulation of one process drives another process, but the first process remains unchanged. Consider, for example, a mentoring program for drug addicts that includes the regular provision of a substitute drug (e.g., methadone) that mitigates the negative consequences of addiction. The delivery of the substitute drug has consequences, but the act of providing the substitute drug remains routine and unchanged.

A side effect is exploitative if regulatory processes benefit one party while being detrimental to another party. For example, the efforts of a mentor may well be benefiting a mentee, but if the mentee manifests oppositional behavior toward the mentor in response, the mentor’s motivation to continue supporting the mentee may suffer.

Finally, an allostatic side effect occurs when one regulatory process remains unchanged while it damages another. An example of would be the repeated implementation of a training routine in talent mentoring in sports that is actually having a detrimental effect on mentees because in the long term it leads to injuries.

Regulatory externalities. Systemic effects of mentoring occur not only within a mentee’s actiotope (i.e., regulatory side effects) but also outside a mentee’s actiotope. Effects outside a mentee’s actiotope are termed externalities. They can have three types of repercussions on a mentee’s actiotope. First, neutral externalities leave a mentee’s actiotope unchanged with regard to mentoring goals. In other words, an external effect may produce no additional regulations with regard to the mentoring objectives. Second, iatrogenic externalities have a negative effect on the pursuance of mentoring goals. We would speak of an iatrogenic externality, for example, in the case of a school mentoring program that facilitates performance gains for a mentee in mathematics who, in turn, is rejected by peers on account of their purported nerdiness. Third, autocatalytic externalities have a positive effect on the pursuance of mentoring goals. We would speak of an autocatalytic externality, for example, when a school mentoring program facilitates performance gains for a mentee in mathematics who then goes on to win a prestigious mathematics scholarship.

Spaces of possibilities in mentoring
The specifications in the NFR-M help to holistically understand regulations for which mentors are responsible in the context of mentoring, that is, their monitoring and control activities in pursuit of mentoring goals (for an overview refer to Table 2). These regulations are intended to bring about change. With the ongoing changes, however, the requirements and thus the role of mentors are changing at various levels. Under certain circumstances, if mentors no longer meet the increased requirements, this can lead to mentees actively seeking new mentors. Consequently, a systemic approach to mentoring not only requires a holistic understanding but also a dynamic understanding of mentoring. Such an approach might also help to resolve the mentoring paradox. Results from meta-analyses and reviews typically refer to a comparison of outcomes, documenting how individual characteristics of mentoring presumably influence the achievement of desired goals. Based on a systemic approach to the subject, we argue that mentoring should be seen as a dynamic contextualized process rather than from a cause-and-effect perspective. Analyses should be primarily interested
in the complex interplay of dynamic processes, wherein goal-oriented mentor-led regulations and synchronization explain mentoring success. To introduce a dynamic understanding of mentoring from a systems perspective, and following the concept of EduSpaces, we will introduce the concept of mentoring spaces, or M-spaces for short.

Conceptually, a dynamic system consists of an abstract phase space or—as we will call it—a space of possibilities. Its coordinates describe the state of a dynamic system at any given moment, thus including future states of the dynamic system. In this way, mentoring pathways can also be mapped in a space of possibilities. Each state relevant in mentoring corresponds to a certain point in a given M-space. However, not every system state must be realized. M-spaces are therefore fundamentally different from the physical space known to us, since they can, for example, also include states that could have existed in the past under different circumstances. They can also contain mentoring pathways that may or may not be realized in the future.

Identifying types of M-spaces of particular interest for mentoring presents a challenge. We suggest categorizing the M-spaces of interest for mentoring into three types: nomological, epistemic, and deontic M-spaces (for an overview refer to Table 2). These M-spaces will help us to get a better understanding of the possibilities in mentoring. They will also help to get a better understanding of whether mentors’ ideas about effective measures in mentoring and mentoring goals are compatible with a mentee’s actiotope.

**Nomological M-spaces.** A nomological space of possibilities is limited by what is actually possible in reality. Reality thus happens in nomological spaces of possibilities.

Nomological M-spaces contain all possibilities of a mentee’s actiotope that are in accordance with reality. In the following, we will give three examples how M-spaces might be helpful for getting a better understanding of possibilities in mentoring. First, within nomological M-spaces, it is possible to assess what would have happened if a mentor had chosen an alternative course of action. Second, when constructing a mentoring pathway within a nomological M-space, the chances of realizing that pathway within a mentee’s actiotope can be systematically analyzed. Third, the main goal of empirical research on mentoring could be the cartography of its nomological M-spaces.

**Epistemic M-spaces.** Generally speaking, an epistemic space of possibilities comprises all possible states of a dynamic system that a person (or any other intelligence, including an artificial one) can mentally construct. These do not have to be in accordance with the laws of nature but can be—as in science fiction—purely fantastic. Similarly, an epistemic M-space comprises any state of a mentee’s actiotope that a mentor can conceive.

The relationship of nomological and epistemic M-spaces in mentoring is entangled. Realizable mentoring pathways are often not readily imaginable for the mentors. Hence, meaningful, realizable support measures that exist in nomological M-spaces are not being inducted into a mentor’s epistemic M-spaces owing to a lack of representation. Mentors can also develop mentoring pathways in an epistemic M-space that, for various reasons, cannot be implemented in reality (i.e., they are not represented in nomological M-spaces). In fact, clarifying the overlap of epistemic and nomological M-spaces should, we argue, be one of the core tasks of mentoring research. The clarification deals with questions such as the following: Are mentors familiar with the strengths and weaknesses of their mentee? Do they know their mentee’s actiotope? Do they develop realistic mentoring pathways?

**Deontic M-spaces.** Transitions from one state in a space of possibilities to the next state do not happen randomly. Deontic possibility spaces comprise the preferred states of a dynamic system. They are controlled by attractors. Attractors describe preferred states of a system. Negative attractors act as repellers by describing states that a system avoids. A deontic M-space describes the preferred states of a mentee’s actiotope. A given actiotope state may be preferred for a variety of reasons. Deontic mentoring spaces are usually constructed on the basis of norms, ethical standards, or personal wishes. The

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*b* The etymology of the term *deontic* is not clear. Merriam-Webster’s dictionary speculates that the origin is the Greek word *deon*, which might be the neuter form of the present participle of *dein*, which means to lack, be needful.
discussion about the right mentoring approaches and goals takes place mainly in deontic possibility spaces.

Deontic M-spaces relate to other M-spaces in complex ways. From the vantage point of their epistemic mentoring space, a mentor might, for example, not recognize relevant opportunities within the nomological M-space and, as a result, construct a deontic M-space with suboptimal mentoring goals. Moreover, interpersonal conflicts are always a possibility during mentoring. Such a conflict might turn, for example, on the different goals that a mentee and a mentor have for the mentoring experience. In such a case, the mentor and mentee would be operating in different deontic M-spaces.

**Athena Mentor**

Athena Mentor is an allegory for the ideal mentor. She personifies ideal manifestations of all the mentoring concepts we already introduced and relates them, tellingly, to those we will introduce in this final section (i.e., regulatory insight, regulatory power, and space conflicts). All of these concepts must be contemplated in concert with one another to understand successful mentoring from a systemic perspective. A systemic perspective on effective mentoring is, as we argued at the outset, the approach best suited to address the mentoring paradox. To the best of our knowledge, no other concept is more apt to this end—contemplating mentoring as a case of systemic regulation—than that of the ideal mentor. We briefly describe the ideal coalescence of mentoring components in Athena Mentor.

First, Athena Mentor has perfect knowledge of her mentee's M-spaces. She knows her mentee's nomological space of possibilities. In other words, the nomological M-space is a subset of Athena Mentor's epistemic M-space. Her epistemic M-space also includes insight into the optimal implementation of mentoring goals. Thus, a perfect deontic M-space overlaps with Athena Mentor's epistemic M-space. She is also able to handle space conflicts, which we will introduce shortly. Second, just as Athena was able to transform herself into Mentor and Mentes and, thereby, to defy the worldly laws of nature through her divine regulatory powers, Athena Mentor can become active. Athena Mentor uses her superhuman powers to optimally promote her mentee's actiotope. She carries out regulatory activities (e.g., advising the mentee), sets the right goals, provides emotional support, serves as a role model, introduces her charge to the field, and acts as a door-opener. The Athena Mentor figure thus possesses both perfect knowledge and perfect regulatory skills—regulatory insight and regulatory power (for more information see below). Figure 1 illustrates the figure of Athena Mentor with her perfect knowledge of her mentee's M-spaces, her regulatory insight, regulatory power, and her capability of solving space conflicts.

In sum, the figure of Athena Mentor not only enables the comparison of multiple real mentoring episodes, but also facilitates the juxtaposition of real mentoring episodes and ideal mentoring episodes. She thereby provides an analytical benchmark for the possible in mentoring, which is crucial for appraising the extent of the mentoring paradox.

**Regulatory insight, regulatory power, space conflicts, and the mentoring paradox**

The mentoring paradox describes the wide spectrum of mentoring outcomes, ranging from...
Regulatory insight: A mentor's ability to form functional (i.e., based on the nomological M-space) epistemic and deontic M-spaces is called regulatory insight. Regulatory insight includes mentoring insight, domain insight, and actiotope insight. It also includes knowledge about the nine regulatory dimensions and their optimal implementation specified in the NFR-M.

1. **Mentoring insight** refers to knowledge about what mentoring is and how to conduct successful mentoring.
2. **Domain insight** refers to knowledge about the field in which the mentoring is being conducted.
3. **Actiotope insight** refers to knowledge about a mentee's goals, action repertoire, environment, and subjective action space and their systemic interactions.

Regulatory power: Regulatory power refers to the degree to which a mentor can implement mentoring pathways. Regulatory power is closely related to regulatory resources. First, the more regulatory resources a mentor has, the more effective the mentoring pathways will be that exist in her nomological M-space and lead to the mentoring objectives. Second, as a mentor’s regulatory power increases, so does the amount of resources in a mentoring episode. Four factors help to determine the quality and quantity of available resources in a given mentoring episode:

1. **Mentors** differ in the extent to which they themselves contribute resources to mentoring.
2. **Mentoring programs** or the institutions that conduct the mentoring provide the mentors with various resources for regulation.
3. **Mentees** bring different amounts of educational and learning capital to mentoring.
4. The mentor may also receive resources from **external sources**.

Space conflicts: Tensions within and between M-spaces are called space conflicts.

1. **Space conflicts within nomological M-space** describe tensions between regulations that support mentees' normal pathways (not related to the mentoring objective) and regulations that support mentees' mentoring pathways (that are related to the mentoring objective).
2. **Space conflicts of deontic M-space** arise when states of the mentoring pathway or mentoring goals are being simultaneously accepted and rejected.
3. **Space conflicts within epistemic M-space** describe tensions between possibilities of mentees’ actiotope that can be conceived or mentally constructed.
4. **Interspace conflicts** describe tensions between each of the three M-spaces.

Negative effects to marked positive effects. In this section, we will discuss three concepts useful for analyzing the probability of success of mentoring—regulatory insight, regulatory power, and space conflicts—that can be applied to the nine regulatory dimensions in mentoring (for an overview refer to Table 3).

**Regulatory insight**
Athena Mentor has the ability to map the nomological M-space in her epistemic M-space. She can therefore identify both optimal mentoring objectives in the deontic M-space and the best mentoring pathways within the epistemic M-space. This is, however, only the constructed ideal. In practice, mentors will deviate from this ideal. We call a mentor’s ability to form functional (i.e., on the basis of the nomological M-space) epistemic and deontic M-Spaces **regulatory insight**. Regulatory insight includes mentoring insight, domain insight, and actiotope insight.

Not only does a mentor need to know what mentoring is and how to conduct successful mentoring (mentoring insight), but they also need to know more about the field in which the mentoring is being conducted (domain insight). An example of this is youth mentoring on substance abuse. Moreover, a mentor also needs detailed knowledge about the special situation of their mentee: her goals, action repertoire (e.g., her knowledge, skills), her environment (e.g., support by or problems with parents, peers, teachers), and subjective action space (e.g., her self-confidence) as well as about the systemic interactions of these determinants (i.e., actiotope insight).

Mentoring insight, domain insight, and actiotope insight cannot be assumed to be equally available to all mentors. Therefore, it is important that prospective mentors always receive training in all three areas. We have published descriptions of how such mentor training unfolds in our mentoring programs, which always address all three forms of insight. Such training programs include (1) a general introduction to mentoring (e.g., information on guiding a mentee), (2) domain-specific
information in the subject area of a given mentoring program (e.g., in a mentoring program focusing on promoting girls in STEM, information about the effects of gender stereotypes), and (3) simple diagnostic strategies that mentors can use to familiarize themselves with their mentee and the mentee’s actiotope.

There is evidence at various levels that mentoring is more successful when the mentors have greater regulatory insight. At the program level, mentoring is more successful when the mentoring program has a clearly articulated theoretical–empirical basis. At the mentor level, mentors who have been trained or have higher levels of competence achieve better mentoring outcomes. At the level of the mentor–mentee dyad, mentors are more effective when they know their mentees better, either because the mentor and mentee interact personally or have more frequent personal contact. At the mentee level, mentoring episodes are more successful where mentors have been able to pass on their insights to mentees, for example, by teaching them to navigate the unwritten rules and the norms of a profession.

Let us get back to the figure of Athena Mentor and her perfect regulatory insight: as we have seen above, her regulatory insight, first, includes perfect knowledge of mentoring, the mentoring domain at hand, and the mentee’s actiotope. Her regulatory insight includes, second, knowledge about the optimal regulatory options in light of the nine regulatory dimensions of the NFR-M. Successful mentors come closer to the ideal of Athena Mentor in how they handle these regulatory dimensions.

We will now provide examples of questions concerning regulatory processes in mentoring and what kind of regulatory insights can help to optimally answer them:

- Which processes should be regulated? In youth mentoring, for example, a mentor weighs the pros and cons of advising a mentee about social relations. This requires the mentor to have insight concerning the regulatory network.
- What would be the best function of a given regulation? For example, a mentor considers advising a mentee to maintain a state or to pursue growth goals with respect to variables such as physical fitness, self-esteem, and skills. Here, the mentor is drawing on insights about regulatory function, homeostasis, and homeorhesis.
- Which stakeholder should implement a given regulation? For example, a mentor in a school mentoring program considers whether they or their mentee should create a learning plan for the mentee. In doing so, the mentor is drawing on insight about the control type.
- When should a given activity be carried out? For example, in a weight-loss program, a mentor considers whether their mentee should snack at a certain time or when the mentee is hungry. The mentoring is thus relying on insight about the regulatory type.
- Should an activity remain unchanged or be adapted? For example, a mentor grants young entrepreneurs an increasing amount of autonomy in their decision making as they gain experience. The mentor is thus relying on insight concerning the regulatory form.
- Have all requisite detective, corrective, and preventive regulations been implemented? A mentor will review this question of whether, for example, a mentor sees that their mentee failed to adequately prepare for an important meeting with the mentee’s new supervisor (insight concerning the regulatory activity).
- Have all advisable, available, and ascertainable endogenous and exogenous resources been pulled together? For example, a mentor in a school mentoring program considers this question when they realize that they have overlooked the fact that successful peers of the mentee could serve as role models (insight concerning resources).
- Are there side effects of regulatory actions within a mentee’s actiotope that affect the planned mentoring pathway? For example, a mentor in a school mentoring program considers this question after seeing that an ostensibly effective increase in study time—that produced learning gains—came at the cost of depriving the mentee of time for friends, which, in turn, led to motivational problems (insight concerning regulatory side effects).
- Do the consequences of regulatory activities outside the actiotope feed back into the

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mentee’s actiotope and affect the mentoring pathway? For example, in talent mentoring, a mentor sees their mentee, who recently won an international competition, struggle to come to terms with owning an Instagram account with 50,000 followers and then begins to ponder whether preventive steps should have been taken earlier on to help the mentee cope more effectively with increasing fame (insight concerning regulatory externalities).

Regulatory power
Athena Mentor not only has perfect regulatory insight concerning mentoring, the mentoring domain, her mentee’s actiotope, and the nine regulatory dimensions and their optimal implementation, she also can become active and bring that knowledge into action. She thus has perfect regulatory power. Regulatory power encompasses all decisions concerning the nine regulatory dimensions. A mentor’s regulatory power is closely related to regulatory resources. First, the more regulatory resources a mentor has, the more effective the mentoring pathways will be that exist in the nomological M-space and lead the mentee and mentor toward their mentoring objectives. Second, as a mentor’s regulatory power increases, so do the quality and quantity of resources in a mentoring episode. We distinguish four factors that help determine the quality and quantity of available resources in a given mentoring episode—(1) the mentor, (2) the program, (3) the mentee, and (4) external sources. In the following, we will describe each factor.

Mentors—factor (1)—differ in the extent to which they contribute resources to mentoring. The more resources they can bring in themselves, the more viable mentoring pathways the mentor and mentee will have at their disposal for achieving mentoring goals. For example, mentors are more successful if they are better connected politically, socially, or professionally and thus can act as door openers for their mentees. A telling example is mentors who are able to write particularly effective letters of recommendation, thus giving their mentees access to professional opportunities that would otherwise have been inaccessible to them. Mentoring programs—factor (2)—provide mentors with various resources for regulation. For example, in-person mentoring and online mentoring offer mentors different didactic options. Mentees—factor (3)—bring different amounts of educational and learning capital to mentoring. The availability or lack of a mentee’s resources help determine the extent of a mentor’s regulatory power. For example, if a mentee’s family and friends value learning (cultural educational capital) and a mentee spends most of her time reading and learning (attentional educational capital), then a mentor has more regulatory power in talent development. Finally, a mentor may also receive resources from external sources—factor (4). For example, if a successful mentee attracts sponsors, the financial support provided by the sponsors may open up new opportunities for mentoring.

In this regard, it is instructive that the strongest mentoring effects are found in talent mentoring. This is not surprising from the perspective of regulatory power. We will consider the four factors of regulatory power in the case of the father of nuclear physics, Ernest Rutherford, who was a mentor to several Nobel laureates.

As a mentor—factor (1)—Rutherford possessed immense regulatory power that he could bring to the mentee’s actiotope (his network, his influence, his capacity as a role model, etc.). He was a Nobel laureate himself. In his interviews with American Nobel laureates, Zuckerman found that many of them had a Nobel laureate as a mentor themselves and had been quite choosy when selecting a mentor. The importance of having the right connections was demonstrated, for example, by Chariker et al. in a big-data network analysis of academic networks. With regard to the program—factor (2)—Rutherford’s mentoring could draw on the outstanding resources of the eminent Cavendish Laboratory, the Department of Physics, at the University of Cambridge, which he directed. Rutherford’s mentees—factor (3)—who later won Nobel Prizes themselves, had only been accepted by Rutherford because they had already reached a remarkable level of achievement. Hence, his mentees brought far above-average endogenous and exogenous resources (learning and educational capital) into the mentoring relationship. Finally, the Cavendish Laboratory had outstanding supporters—factor (4). This circumstance is reflected, for example, by the fact that 28 Nobel Prizes have been awarded to members of the Institute to date. The institute’s outstanding reputation...
ensured a constant influx of further resources for research (e.g., government and third-party funding), which meant an almost inexhaustible resource supply for Rutherford’s mentoring.

Space conflicts
Besides perfect regulatory insight and regulatory power, Athena Mentor also has the ability of competently handling space conflicts. What does this mean? Every mentoring episode is likely rife with tensions, both within and between the possible (i.e., nomological M-space), the desirable (i.e., the deontic M-space), and the conceivable (i.e., the epistemic M-space) as well as between the central participants (i.e., mentor and mentee) and additional stakeholders (e.g., parents, teachers, and peers). Tensions within and between M-spaces are referred to as space conflicts. In the following, we will discuss these space conflicts in more detail.

Space conflicts within nomological M-space. While arguably self-evident, when introducing space conflicts within nomological M-space it is important to remember the reason for implementing mentoring in the first place. Mentoring is implemented because the stakeholders think goals set for mentoring will not be achieved otherwise; the normal regulatory processes in the life of the mentee would presumably not bring the mentee successfully along the desired trajectory. In a sense, a mentor is helping a mentee to transcend the mentee’s pre-mentor reality. The mentors contribute to the regulatory processes made possible in mentoring by making regulatory efforts to help the mentee achieve desired states.

In nomological M-space, at least two types of trajectories are important. We describe each by way of a different question. First, what would have happened without the mentoring? In other words, what would the mentee’s nonmentoring pathway have been? Second, what is achieved through mentoring. In other words, what mentoring pathway results for a mentee through mentoring?

Processes can be subject to several regulations at the same time. The regulations that threaten to keep a mentee on the nonmentoring pathway (i.e., the pathway unaffected by the mentoring objectives) during mentoring are often still in effect once mentoring has commenced. These regulations are in tension with the mentoring pathway. The regulations in a mentee’s actiotope support- ing the nonmentoring pathway are antagonistic to the mentoring. For example, we conducted mentoring programs with girls interested in STEM. The participating girls were exposed to the gender stereotype of STEM as an unfeminine domain before, during, and after the mentoring program. In a nomological M-space, the girls’ gains in STEM interest have to overcome opposing—comorbid—social influences pulling the girls away from STEM. Therefore, the more alternative regulations countermand the mentoring objectives, that is, the bigger the space conflicts within the nomological M-space become, the less opportunity the mentee will have to advance along a mentoring pathway and the less successful the mentoring will be.

Space conflicts of deontic M-space. Space conflicts within deontic M-space arise when states of the mentoring pathway or mentoring goals are being simultaneously accepted and rejected. For example, not everything that could lead to objectively greater mentoring success (e.g., extensive learning episodes, doping) is also ethically desirable. The reasons for and aspects that have to be considered concerning space conflicts within deontic M-space are manifold. For reasons of simplicity, we propose a tripartite categorization of space conflicts that might arise within deontic M-space. First, mentoring pathways and goals might be accepted or rejected for professional reasons. For example, a mentor might choose a mentoring pathway that includes extensive learning episodes and extremely challenging mentoring goals because the mentor considers this pathway the best means of facilitating the mentee’s achievement of a certain standard of excellence. Second, mentoring pathways and goals might be accepted or rejected based on ethical and cultural reasons. For example, mentors not only plan learning pathways and mentoring goals based on success criteria but also consider the ethical and cultural implications of their mentoring activities. Third, mentoring pathways and goals might be accepted or rejected based on personal reasons. Mentors may have very different personal interests and preferences when it comes to choosing mentoring pathways and goals. For example, in a study by Allen et al., mentors named goals as diverse as the desire to pass information on to others, the desire to help others succeed, the desire to benefit the organization, the desire to help
minorities or women move through organizational ranks, or the desire to increase personal learning.

It is likely that conflicts of various kinds may occur simultaneously within deontic M-space. For example, there might be conflicts within each of the three groups of reasons for accepting or rejecting mentoring pathways and goals. For example, there might be a disagreeable trade-off between two professional goals that cannot be pursued simultaneously (e.g., increasing the mentee’s study time for both math and sciences at the same time). There might also be conflicts across the groups of reasons such as an overambitious mentor (i.e., a personal reason) who may experience moral conflicts (i.e., an ethical reason).

Mentoring is a multi-agent phenomenon. Conflicts can arise between the deontic M-spaces of the central participants (i.e., mentor and mentee) and additional stakeholders (e.g., friends and superiors) involved in mentoring. For this reason, clearly defined and communicated intentions and goals of mentoring programs have long been considered an important success factor.

Space conflicts within epistemic M-space. Mentoring-related conflicts can arise within epistemic M-space. Space conflicts within epistemic M-space describe tensions between possibilities of mentees’ actiotopes that can be conceived or mentally constructed. We propose distinguishing three basic types of conflicts within epistemic M-space. First, conflicts related to incompleteness involve possible mentoring pathways or goals that are not being recognized. For example, a mentor in a school mentoring program in STEM might set a career goal together with her mentee that, it turns out, was not well chosen because it was set without adequate insight into the professional possibilities within the STEM field of interest of her mentee. Second, conflicts may involve contradictions arising from inconsistent assumptions and beliefs about the best mentoring pathways and best mentoring goals. For example, a mentor in talent mentoring might suggest a learning pathway that is not challenging enough because she misjudges her mentees motivation and competence level. Third, multi-agent conflicts occur when those directly and indirectly involved in mentoring have different assumptions and beliefs about the best mentoring goals and mentoring pathways.

Interspace conflicts. With our previous comments on space conflicts, we already hinted at interspace conflicts. Interspace conflicts describe tensions between each of the three types of M-spaces. An interspace conflict between epistemic and nomological M-space would exist if, for example, a mentor is mistaken about the effectiveness of her regulations. An interspace conflict between nomological and deontic M-space would exist, for example, if not all means of achieving mentoring goals are ethically acceptable (e.g., exerting coercive pressure on a mentee). An interspace conflict between deontic and epistemic M-space would exist, for example, if a mentor misjudges the potential of their mentee on account of a stereotype held by the mentor about the mentee’s cultural–ethnic heritage.

Summary and conclusion

In the context of this paper, the term “mentoring paradox” describes the surprising heterogeneity of effects and effect sizes of mentoring reported in the research literature. They range from negative effects to large effects that have been counted among the strongest effects observed among educational measures. In between these extremes, meta-analyses usually find only small to moderate effect sizes. Despite research efforts to date, it has not yet been possible to solve the mentoring paradox.

In light of the divergent empirical findings expressed by the mentoring paradox, the current lack of a generally accepted theoretical framework for a comparative analysis of mentoring effectiveness qualifies as a critical shortcoming within the research on mentoring. Results from meta-analyses and reviews typically refer to a comparison of outcomes, documenting how well different mentoring episodes achieve the same goals. Studies have also considered individual characteristics of mentoring that presumably influence the achievement of desired goals. Thus, the topic often is approached from a cause-and-effect perspective. We argue that a systemic approach to the subject might have various advantages in solving the mentoring paradox. In such an approach, mentoring is seen as a dynamic contextualized process, and analyses are primarily interested in the complex interplay of processes, wherein goal-oriented mentor-led...
regulations and synchronization explain mentoring success.

This article developed conceptual tools with which to analyze these complex processes within mentoring and thus offers a new approach to explaining the mentoring paradox. To this end, we first proposed essential working definitions. We introduced a working definition of mentoring. We do not advocate that our definition should replace existing definitions. On the contrary, as mentoring is not a "natural kind," a plurality of definitions is acceptable and potentially helpful. The reason for introducing our working definitions was to create a basis of understanding for the types of conceptual systemic analyses we then proposed. We also introduced working definitions for the concepts of the mentoring episode and the mentoring pathway. These are useful for analyzing situational, temporal, and dynamic aspects of mentoring. As a unit of analysis, we suggested mentees’ actiotopes and their interaction with other systems. As categories of analysis, we suggested regulations of which mentors are responsible in the context of mentoring, that is, mentors' monitoring and control activities in pursuit of a mentoring goal. We elaborated on these regulations in the NFR-M. The actiotope as unit of analysis and the regulations specified in the NFR-M enable a holistic approach to mentoring. Our introduction of spaces of possibilities in mentoring (M-spaces) enables a dynamic view of mentoring that together with the holistic approach is essential for analyzing mentoring and its success from a systemic perspective.

To bring all our theoretical concepts together and broaden them in a way that is helpful to resolve the mentoring paradox, we introduced the figure of Athena Mentor. She is an allegory for the ideal mentor, who possesses complete regulatory insight and regulatory power. The Athena Mentor concept can help resolve the mentoring paradox, we assert, by providing an analytical framework that extends previous metadisciplinary discussions of mentoring. Athena Mentor not only enables the comparison of multiple real mentoring episodes, but also facilitates the juxtaposition of real mentoring episodes and ideal mentoring episodes. She thereby provides an analytical benchmark for the possible in mentoring, which is crucial for appraising the extent of the mentoring paradox. Moreover, we also see utility of the Athena Mentor figure for designing and implementing mentoring. As the strong effects reported in the mentoring literature prove, mentoring has enormous potential. The Athena Mentor allegory can help mentors and mentoring program administrators to keep the full potential of mentoring in mind when doing mentoring.

With regard to its theoretical application, our conceptual analyses suggest four approaches to clarifying the mentoring paradox. In closing, we describe each of these briefly to encourage future research.

Resolution of the mentoring paradox 1: mentoring comparisons based on the NFR-M

The NFR-M—based on work presented in the nonagonal framework of regulation in talent development (NFR-TD)—is at the core of the proposed conceptual framework. The NFR-M aims to provide a conceptual tool that captures all relevant dimensions of mentors’ activities in the context of their mentoring. However, the nine dimensions of the model are not designed as a sequential process, because such a linear dimension-based decomposition of mentoring episodes or mentoring pathways into distinct phases is not possible. In reality, the nine dimensions are always intertwined and inseparably linked. For heuristic reasons, however, it can be quite useful to identify phases in mentoring during which mentors focus more on individual dimensions. It should be emphasized, however, that mentors do not focus on certain aspects because there are separate dimensions per se, but rather because the simultaneous processing of all nine dimensions of the NFR-M is not possible in light of limited human regulatory, processing, and attention capacity.

The general hypothesis regarding the mentoring paradox is that more successful mentoring differs in the effectiveness of the regulations in the nine dimensions. Some of these dimensions have yet to be made the systematic focus of empirical studies on mentoring. Examples of understudied dimensions include the systemic effects of mentoring in the mentee’s actiotope (i.e., regulatory side effects) and the regulatory externalities that affect a mentee’s actiotope. One can speculate that systemic effects and regulatory externalities constitute one of the reasons for the negative effects of mentoring.
Resolution of the mentoring paradox 2: comparisons of the mentors’ regulatory insight

The NFR-M suggests that there are various ways of resolving the mentoring paradox. Mentoring can be analyzed in terms of the regulatory insight the mentor has with regard to all nine dimensions of the NFR-M. The three aspects of regulatory insight we underscored as being important are mentoring insight (i.e., knowledge about what mentoring is and how to conduct successful mentoring), domain insight (i.e., knowledge about the field in which mentoring is being conducted), and actiotope insight (i.e., knowledge about a mentee’s goals, action repertoire, environment, subjective action space and their interactions). A general hypothesis for resolving the mentoring paradox is that during mentoring episodes with more successful outcomes, mentors will have demonstrated higher levels of regulatory insight.

Resolution of the mentoring paradox 3: comparisons regarding the regulatory power of the mentor

The regulatory power of mentors can vary substantially for a number of reasons. Mentors differ in the extent to which they contribute resources to mentoring. The mentoring program or institution conducting the mentoring program provides mentors with different amounts of resources for regulation. Mentees’ educational and learning capital influences mentors’ regulatory decisions and possibilities. Finally, external sources bring different resources to mentoring episodes that the mentor can—but may fail to—use for regulatory purposes. The general hypothesis for resolving the mentoring paradox is that the more regulatory power a mentor has, the more successful the outcomes of their mentoring will be.

Regulatory insight and regulatory power are, however, complementary. Without regulatory insight, regulatory power is akin to a fire hose in the hands of a child and thus likely inefficacious. Without regulatory power, regulatory insights are also useless and in the strict sense of the word powerless.

The explanation of mentoring outcomes through regulatory insight and regulatory power with regard to the nine dimensions of the NFR-M is straightforward. One can nevertheless bring other key constructs into focus that—in combination with regulatory insight and regulatory power—might help resolving the mentoring paradox. For example, mentors who have a positive relationship quality with their mentee will be better accepted and consequently have more regulatory power. Social–emotional influences on regulatory power can be studied from a similar angle. For example, Sipe found that mentors who focused first on building trust with and befriending their adolescent charges tended to be more effective than those who immediately aimed at changing their mentee’s behavior.

Resolution of the mentoring paradox 4: M-spaces

Mentoring is always carried out at the intersections of what is possible in reality, what is conceivable by the people involved in the mentoring, and what is desired by them. To capture these different levels of mentoring, we introduced three different spaces of possibilities in mentoring (M-spaces). The nomological M-space reflects those mentoring pathways and mentoring goals that are possible in reality. The epistemic M-space reflects those mentoring pathways and mentoring goals that are conceivable by those involved in the mentoring. The deontic M-space reflects those mentoring pathways and mentoring goals that different actors involved in the mentoring prefer or desire.

Tensions within and between M-spaces (i.e., space conflicts) can have far-reaching consequences for the effectiveness of mentoring. Assessing these space conflicts can help to understand differences in the effectiveness of mentoring. For example, the nomological M-space of a mentoring episode can be used to analyze which parts of reality countervail the mentoring goals. We already noted the example of the role played by gender stereotypes about the talents of girls and women in STEM. In the past, these stereotypes might have contributed to the development of gender differences among mentees. In the present, mentees might still be exposed to these stereotypes in their everyday lives, even if mentors try to act against them. In the future, after completing the mentoring, the effects of the mentoring in refuting the gender stereotype must be persistent enough to ensure that the former mentees do not eventually regress back to the stereotype in their thinking. In other words, the mentoring
needs to be substantial enough to ensure that the mentees’ post-mentoring actiotopes are sufficiently stable. Besides the conflict within one type of M-space, interspatial conflicts can also occur, that is, conflicts between different types of M-spaces. For example, an overambitious mentor in a school mentoring program may not represent the most effective mentoring goal in her deontic M-space conceivable within a mentee's nomological M-space, thus overexerting her mentee.

M-spaces also facilitate the analysis of the compatibility of ideas about effective measures in mentoring (i.e., the compatibility of epistemic M-spaces) or the compatibility of mentoring goals (i.e., compatibility of deontic M-spaces) of all those involved in mentoring. Thus, the general hypothesis for resolving the mentoring paradox is that the better a mentor is in analyzing the compatibility of M-spaces and in resolving space conflicts, the more successful the outcomes of their mentoring will be.

However, M-spaces can also be used to represent the three aforementioned approaches to resolving the mentoring paradox. These include (1) the analyses of the nine dimensions of the NFR-M within each of the M-spaces, (2) the concepts of regulatory insight of the mentor (i.e., how well a mentor can realize nomological M-space within her epistemic M-space), and (3) the regulatory power of the mentor (i.e., the mentoring pathways available to the mentor in nomological M-space). Taken together, the new constructs introduced suggest novel analytical approaches to investigating why some mentoring programs are much more effective than others; they should also be useful for finding ideas when designing and implementing new and existing mentoring programs. By encouraging new approaches in research and practice, we hope the NFR-M can contribute to improving the net value of mentoring for mentees and society.

So far, these are all just theoretical suggestions on how to solve the mentoring paradox. To make sure our theoretical framework is actually helpful in this regard, as well as for research and practice in a broader sense, it has to be empirically tested. The scope of this manuscript does not allow us to go into detail. An elaboration of this would be the topic of another manuscript. To conclude, we will briefly address the challenges of empirically testing our approach. Our framework represents a systemic approach. Mentoring consists of a myriad of necessarily coalescing regulatory processes and interactions between the processes distributed across the mentee’s actiotope—with repercussions outside the mentee’s actiotope that might eventually feed back into it. As research on critical events has shown, the outcome of complex processes can depend on small details. An empirical research program would thus need to map the shifting and changing roles, strengths, and relationships of the regulatory dimensions over time in nonlinear ways. Such an understanding requires new methods, which include qualitative as well as quantitative approaches. Unfortunately, there are currently only preliminary, albeit promising, steps in this area. Empirically testing our theoretical framework would necessitate further developing traditional empirical methods in order to investigate mentoring in its full complexity and dynamics.

Author contributions
A.Z. shared in the discussion, manuscript preparation, and final writing. K.G. and M.H. shared in the discussion, literature search, and formatting. H.S. shared in the discussion, literature search, and revision of manuscript.

Competing interests
The authors declare no competing interests.

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