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The potential of the empathic ability for the performance of civil engineering projects

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Abstract

Purpose – The increasing complexity of civil engineering projects necessitates focusing on new competencies of project participants. Based on the research on team performance and design processes that are more closely linked to the relevance of the project context, it is hypothesised that empathic abilities could play an important role in the performance of civil engineering projects. Therefore, this study aims to investigate whether performance can be improved by focusing on empathic abilities during the integrated design phase.

Design/methodology/approach – Semi-structured in-depth interviews with experts were conducted to explore the relevance of empathic abilities and their interaction with performance in a real-life infrastructure project. The project team's empathy level was measured by means of a survey using Davis' Interpersonal Reactivity Index method. Finally, differences between expected and measured levels of empathy were analysed.

Findings – The results provide insights into how empathic abilities interact with performance. The measurement indicates that, on average, professionals in the civil engineering industry score relatively low on empathy. In addition, differences were identified between the expected distribution and the measured empathy levels of the team, implying a potential for improvement, in particular by increasing the empathic abilities of the project management and increasing gender diversity.

Originality/value – To the best of the authors' knowledge, this study is the first to investigate a relationship between empathy and the performance of civil engineering projects. The results provide initial insights into the empathic ability of civil engineering project teams and the potential of empathy to improve performance. Furthermore, from an empathy perspective, this study advocates increasing the gender diversity of project teams to improve performance.

Keywords Design, Diversity, Empathy, Project performance, Project management

Paper type Research paper

1. Introduction

Civil engineering projects have become increasingly complex in recent decades. This is driven by a growing need for mobility and urbanisation (Eurostat, 2016), inducing the need to combine functions to make projects feasible (Hertogh, 2013). Today, combinations of mobility functions with ecological, water management or real estate functions are common.

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Consequently, new aspects – such as ecology, technical installations, architecture and landscaping – need to be integrated or play a more dominant role in the projects. In addition, the impact of stakeholders has increased as a result of building in more urbanised areas and stakeholders becoming more assertive (Maddaloni and Davis, 2017; Mashali *et al.*, 2022). As a result, project complexity has increased due to a growing number of elements in projects (Vidal and Marle, 2008) and an increasingly dynamic impact of stakeholders (Hertogh and Westerveld, 2010; Maier and Fadel, 2006). Dorst (2019) argues that the increased complexity of the problem definition and the solution space has led to the achievement of human cognitive capacities to find solutions using conventional design methods.

The trend of integrating an increasing number of aspects, and thus the increasing complexity of projects, will continue in the coming decades. Civil engineering projects face major challenges, such as the inclusion of climate adaptation, biodiversity, circularity and social inequality (IPCC, 2022; Wilkinson, 2019). The adoption and integration of these aspects has become dominant in civil engineering projects (Demirkesen and Ozorhon, 2017), with the integration of stakeholder interests and disciplines becoming particularly challenging (Keusters *et al.*, 2022).

Meanwhile, civil engineering projects are beset by poor performance, which is often described in terms of "the iron triangle" criteria of project management: cost, time and quality (Nicholas and Steyn, 2017). Today, however, criteria such as stakeholder satisfaction and safety have also grown in importance (Davis, 2014; Silva *et al.*, 2019). In this study, project performance is defined as the extent to which the project meets its pre-defined goals related to cost, time, quality, safety and stakeholders' satisfaction. It is broadly concluded that the pre-defined goals of civil engineering projects are hard to meet (Flyvbjerg, 2013; Locatelli *et al.*, 2017).

The question arises as to whether the transition to integration challenges affects the team's competencies to deliver more successful projects, given the relationship between team participants' competencies and project performance that has been demonstrated in the literature (Bakker and de Kleijn, 2014). The literature indicates a positive connection between the team's emotional intelligence (EI) and project performance in large-scale infrastructure projects (Khosravi *et al.*, 2020; Rezvani *et al.*, 2019). EI is defined as a cognitive ability to perceive emotions; use emotions to facilitate thinking; understand emotions; and manage emotions in oneself and others (Mayer *et al.*, 2004; Clarke, 2008).

Butler and Chinowsky (2006) examined the relationship between EI factors and transformational leadership for the construction industry specifically. They found that construction managers scored particularly low on empathy, with empathy identified as a factor of EI. Therefore, they called for additional attention to be paid to this competence specifically.

Empathy is defined as the ability to experience and understand the feelings of another (Decety and Lamm, 2006; Krznaric, 2014). Although overlapping with aspects of EI, it is distinguished by a focus on affective dimensions, in addition to the cognitive ones. The positive effects of empathy on team performance have been demonstrated (Miyashiro, 2011). Considering design processes as social processes (Bucchiarelli, 1988) and taking empathy as a driver for social cohesion (Roberge, 2013), openness to other's perspectives on the project and empathic communication could contribute to a better working atmosphere and collaboration in general. Moreover, people with high empathic abilities are better able to understand and feel other people's interests and emotions. As such, empathy has been identified as an important personal and team competence to improve project performance through design disciplines such as product design, architecture and landscape design (Devecchi and Guerrini, 2017; Postma *et al.*, 2012; Van der Ryn, 2013). These disciplines are

characterised by a close interaction with the project context by nature and the need for context integration to achieve successful projects.

The ongoing development from technological to integration-driven civil engineering projects includes the increasing need of adoption of project context, as is already common in product design, architecture and landscaping. If stakeholders have an increasing impact on processes and outcome of civil engineering projects, project participants' skills contributing to understanding and adopting stakeholders' interests will become more relevant (Witmer, 2019). Likewise, if more and new disciplines are to be integrated into a design solution, competencies appealing to the involvement of unfamiliar areas of knowledge will become more critical.

The increasing need for context integration justifies the proposition that the relevance of empathic abilities has also increased in civil engineering projects, as empathy can promote feeling and understanding the design problem's context. These abilities will be especially relevant during the integrated design phase, where integration is crucial and where the decisions taken are important for project performance (Koutsikouri *et al.*, 2008; Leon and Laing, 2022). In this study, the integrated design process is defined as the course of all human activities whereby an existing situation is transformed into a new one in to satisfy needs, including and balancing the interests of all parties and disciplines involved (Keusters *et al.*, 2022).

Because the connection between empathy and performance of civil engineering projects is virtually unexplored in literature, this study investigates whether the performance of civil engineering projects can be improved by focusing on the project team's empathy during the integrated design phase. While empathy encompasses cognitive and affective dimensions, this research can provide additional insights compared to previous studies on EI and performance. Firstly, this paper outlines the concept of empathy in general and describes a model of the interaction between empathy and performance in civil engineering projects, followed by a description of the research method. The data were collected from a large infrastructure project in The Netherlands. The analysis and the discussion of the results focus on the gaps between the expected and the actual level of the project team's empathic ability, which in turn leads to conclusions regarding the interaction between empathy and project performance.

2. The concept of empathy

When diving into the literature on empathy, it is easy to get carried away by the many different understandings, interpretations and applications across different disciplines. Authors agree that there is little consistency on how the concept of empathy is defined (Kouprie and Sleeswijk Visser, 2009; Gerdes *et al.*, 2010; Batson, 2009). Empathy can be described as a set of psychological mechanisms (e.g. "identifying with"), as a trait (e.g. "an ability"), as a process ("stepping in and out of the other's situation") and as a set of various components (e.g. "affective and cognitive"). For example, Kohut (1959) defines empathy as "the capacity to think and feel oneself into the inner life of another person". This involves psychological mechanisms such as creating awareness, imagining, perspective-taking, understanding, relating, connecting and identifying with the other person. Also, Baron-Cohen and Wheelwright (2004) explain that empathy allows people to interact with others by understanding their intentions, predicting their behaviour and feeling an emotion as a reaction to this. Such definitions regard empathy as a capacity or ability of psychological mechanisms. The differences with related concepts, such as sympathy or compassion, are also highlighted, because they are often confused with each other (Baron-Cohen and Wheelwright, 2004; Batson, 2009; Köppen and Meinel, 2015). Contrary to sympathy, empathy is when one does not feel the desire to take away someone's suffering. Where the goal of empathy is understanding the other person's experiences, sympathy concerns the other's well-being (Kouprie and Sleeswijk Visser, 2009).

Furthermore, the degree to which a person can be empathic is bounded by someone's ability and willingness. The ability of an individual refers to the extent to which someone can empathise beyond the specific characteristics of his or her group. This is bounded by someone's "empathic horizon" such as gender, education and age (McDonagh-Philp and Denton, 2000). Willingness to be empathic with another refers to someone's personal engagement with another person, which can be influenced by someone's connection to the other, commitment or someone's emotional state.

Different aspects of the concept of empathy include cognitive and affective components. Cognition refers to understanding someone else's feelings, and affection refers to feeling an emotion as a reaction to someone else's emotion (Baron-Cohen and Wheelwright, 2004). The affective and cognitive components of empathy are strongly interrelated (Gerdes *et al.*, 2010; Davis, 1980). Kouprie and Sleeswijk Visser (2009) conclude: "Having an emotional response (affective) to another's emotional state and being able to reflect on that by perspective taking (cognitive) seems to be the core mechanism of empathy".

It should be noted that when this study refers to "empathy", it should be interpreted as a multi-dimensional catch-all concept of individual empathic ability, including the aforementioned aspects, because the concept of empathy is broadly interpreted in the literature. When projected onto the integrated design phase of civil engineering projects, this concept of empathy could enhance the designer's ability to sense and understand the other person's emotion, interest or problem, referring to "the other" as the stakeholder or another colleague in the project organisation. In this way, empathy could contribute to managing the integration challenges of today's projects.

3. Empathy as a driver for project performance

In general, the positive effect of empathy on team performance has been widely discussed (Roberge, 2013;). Empathy increases people's concern for the welfare of another and the team. As a result, team members become able to overcome conflicts and collaborate efficiently with each other, which increases team effectiveness and productivity. In addition, feeling understood by others may lead team members to open up and disclose valuable information that would otherwise not be shared (Roberge, 2013). Furthermore, the literature elaborates on the interaction between empathy and performance through leadership skills. Leadership on the part of the project manager is about leading, directing, guiding, influencing and managing the project team, stakeholders and other participants to achieve the project objectives (Burke and Barron, 2014). There are different leadership styles for doing this. Project managers should have the skills to sense and understand which leadership style is needed (Toor and Ofori, 2008). Empathy is proposed as an important competence supporting this ability (Duff, 2017; Socas, 2018).

The literature also suggests an interaction between empathy and project performance through empathising with the user in a design process (user-centred design). Devecchi and Guerrini (2017) and Postma *et al.* (2012) elaborate on the essential role that empathy plays in this process. Koskinen *et al.* (2003) introduce "Empathic Design" as a method where designers get closer to the lives and experiences of users to increase the likelihood that the product meets the user's needs. The importance of the integrated design process links empathy to the performance of projects.

This study distinguishes between internal and external empathy (Köppen and Meinel, 2015). Internal empathy is interpreted as empathy between people within a certain group or team with the same characteristics and interests to support collaboration and create an emotionally safe working atmosphere that fosters performance (Roberge, 2013). External empathy is defined as empathy between people from different groups with different interests or

perspectives, e.g. between the owner (client), contractor and stakeholders. These participants often have different backgrounds and interests. They need to cooperate and integrate working processes and information to successfully deliver the project (Demirkesen and Ozorhon, 2017). In this case, empathy aims to feel and understand mutual perspectives and interests (Baiden and Price, 2011). Both internal and external empathy seem relevant to civil engineering projects where disciplinary teams need to collaborate in a safe and pleasant atmosphere, and where conflicting interests and wishes between parties need to be overcome.

Based on the literature review, three categories of empathy are identified for the purpose of structuring the investigation into the role of empathy in performance. This follows Köppen and Meinel's (2015) distinction between internal and external empathy. This categorisation can be applied to the integrated design process as follows:

- Team empathy – internal empathy

  Empathy may contribute to a good working atmosphere and better collaboration within disciplinary teams, which will in turn lead to improved performance. Here, internal empathy focuses on personal relationships and job satisfaction.

- Interdisciplinary empathy – internal + external empathy

  Participants of disciplinary teams in a civil engineering project have different interests, processes and cultures. Here, external empathy might contribute to a better understanding each other's challenges or interests, leading to better designs, processes and performance. In addition, in an integrated process, disciplinary teams may also be part of a joint group or project organisation. Therefore, internal empathy may also strengthen interdisciplinary relationships, as described under (1). Interdisciplinary empathy can therefore comprise aspects of both internal and external empathy.

- Interorganisational empathy – external empathy

  Considering integrated civil engineering contracts, the owner, the contractor and the stakeholders have different interests during the integrated design phase that need to be merged into one integrated solution. Therefore, feeling and understanding each other's emotions, wishes and interests might contribute to a better process and integrated solution and performance.

The research model in Figure 1 provided a structure for this study and visualises the hypothesised relationship between the categories of empathy, project performance and the integrated design process.

This study considers integrated contracts, where the responsibility for the integrated design scope mainly rests with the contractor. The importance of the integrated design process for performance has been demonstrated in the literature and was discussed in Section 1 (Koutsikouri *et al.*, 2008; Keusters *et al.*, 2022; Leon and Laing, 2022).

4. Research Method

4.1 Data collection

The research was exploratory to investigate whether relationships between empathy and the performance of civil engineering projects can be identified. The data were collected in February and March 2021 from a real-life, large infrastructure project in the Netherlands that was contracted via a Design, Build, Finance and Maintain contract. The contractor was a joint venture of several companies. They had contracted various engineering firms for the

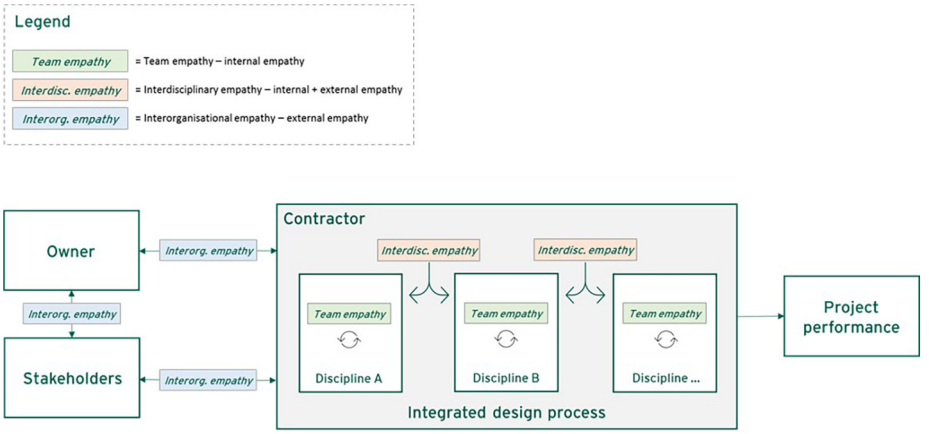

Figure 1.
Research model

Source: Authors' own creation

design assignment. The client was a public owner representing various public agencies (province and municipalities). The project scope comprised bridges, viaducts, tunnels, roadworks, earthworks, ecological works and landscaping. As such, the case was considered a representative infrastructure project.

4.2 Ethics

Generally, all data was retrieved according to the guidelines of the Delft University of Technology ethics committee. Initially, the entire project team was informed about the research through a short presentation without mentioning empathy as a subject of study or the hypothesis. The voluntary nature of the data collection was explained. Then, before the interviews and the survey, the interviewees and participants were informed about the research goals, the interview and survey procedures, data collection, voluntariness, confidentiality and anonymity of the project, interviewees and survey participants, whereupon their informed consent was requested for the use of the collected data. The interviewees, being experienced and highly educated professionals, provided consent, asked no questions nor raised any risks regarding their participation. The analysed sub-groups were chosen such that individuals could not be traced.

4.3 Interviews

Part I of the research aimed to investigate the dominant factors for performance and to explore their interaction with empathy. Eleven semi-structured in-depth interviews were conducted with experts from the owners' and contractors' organisations with project roles: project director, project managers, stakeholder managers, technical design managers and contract managers. Two interviewees were females; nine were males. The interviewees had between 7 and 31 years of experience in the civil engineering sector. The interviews followed a pre-determined questionnaire based on five main questions and were conducted individually and online due to COVID-19 restrictions.

In the first part of the interview, success factors were examined to explore whether empathy interacted with performance. The interviewees were asked open-ended questions to identify the most critical success factor for civil engineering projects and which

improvements could contribute to better performance. The interviewer did not mention empathy in this part of the interview to prevent biased answers. Only if connections with empathy-like competencies emerged the interaction with performance was explored more in detail. After an introduction of the concept of empathy, the second part of the interview focused on the role of empathy in the integrated design phase; when and where empathy might be important in the organisation; and how it might affect the performance criteria costs, time, quality, safety or stakeholder satisfaction.

4.4 Data analysis

The interviews were transcribed and reported. The raw data were the quotes of events reported during the interviews, such as incidents, activities, examples or statements. The interview reports were analysed by highlighting all quotes related to empathy-touching topics. Quotes referring to the same success factors were clustered by theme (thematic concept coding). Open coding was used to optimally facilitate gaining insights into success factors, although *Integration* and *Team competencies* were the initial provisional concepts based on the theory described in Section 1. The comparison of quotes supported the accumulation of concept substantiation or the emergence of new concepts (Corbin and Strauss, 1990). The concepts required precise definitions. New insights during the analysis resulted in adjusted definitions and new (sub)concepts. Consequently, an iterative process unfolded. For the second part of the interviews, the empathy-related quotes were clustered along the three empathy categories introduced in Section 3 (see Figure 1) and sub-clustered along specific roles in the project organisation. Based on this clustering and the accompanying quotes, the researchers could verify the research model of Figure 1 and analyse how empathy interacts with performance.

4.5 Empathy survey

Part II of the research consisted of a survey to measure the project participants' empathic ability and to investigate how this ability is distributed throughout the team. Several methods are available for measuring individual empathic ability, for example, observation methods and neurological scans. A self-report tool was chosen for this study because it is the most commonly used method and it provides valuable data that can be easily accessed.

In this study, the widely used Interpersonal Reactivity Index (IRI) test developed by Davis (1980) was used. One major advantage of this test is the availability of a validated Dutch version by De Corte *et al.* (2007). Furthermore, the IRI test provides insights into the affective and cognitive abilities of the participants by measuring a total empathy score that is composed of four sub-scale scores: Fantasy (FS), Perspective-taking (PT), Empathic concern (EC) and Personal distress (PD). Categories PD and EC assess the affective dimension of empathy, whereas PT represents the cognitive dimension. FS is assigned to both the cognitive construct (Ewin *et al.*, 2020) and the affective construct (De Corte *et al.*, 2007) and is thus more difficult to characterise along the cognitive–affective dimension (Baron-Cohen and Wheelwright, 2004). Each sub-scale is measured by seven questions.

As the project was in the integrated design phase at the time the research was being carried out, and it was assumed that each participant was somehow involved in the design process, all participants working on the project received an invitation to participate in the survey. In total, 514 construction professionals received the questionnaire; 219 people responded, representing a response rate of 43% (25 respondents from the owner's side, 194 from the contractor's side). Participants were asked to answer the questions on a five-point scale, from 0 (does not describe me well) to 4 (describes me very well). In addition, personal characteristics of the respondents were collected, such as age, gender, discipline, role in the project and the number of team

participants they supervised. The data were analysed by using statistical analysis software and comparing different (mean) empathy scores with each other.

While the interviews in Part I of the research provided qualitative insights into the interaction between empathy and project performance, the measurements in Part II had a quantitative character. The combination of the results of Parts I and II creates a mixed-method study and permits an analysis as to whether empathy can provide potential to improve performance.

5. Results and Discussion

5.1. Part I: interviews

The first part of the interviews explored the critical success factors for civil engineering projects and whether they interact with empathic abilities. During the analysis, the initial provisional concept of *Integration* appeared to unravel into *Integration of stakeholders' interests* and *Integration of disciplines*, see Table 1. Then, the initial provisional concept of *Team competencies* was broken down into the concepts of *openness* (referring to an attitude and atmosphere of speaking freely about what is on one's mind); *mutual understanding of interests*; and *communication*. Finally, by open coding, a new concept of *Collaboration* emerged, which turned to be broken down into *collaboration between owner and contractor* and *team collaboration* as the analysis progressed. The interviewees indicated the concepts of *mutual understanding of interests* and *communication* as supportive of the *integration* and *collaboration* concepts. As such, these concepts were not regarded as success factors in themselves. The literature review of Section 3 demonstrated empathy positively correlating with *mutual understanding of interests* and *communication*. In Table 1, parts of the quotes referring to these concepts are indicated in bold and underlined, respectively, showing the broad support of the success factors. On the contrary, the concept of *Openness* was indicated as an independent concept by the interviewees and, for that reason, interpreted as a concept for success.

Thus, the analysis resulted in five main concepts considered essential for performance, see Table 1. The concepts are supported by a selection of quotes from the interviewees representing actions that foster project success and refer to empathy-related behaviour. It should be noted that the quotes used in this analysis were translated from Dutch into English. The overview indicates that empathy-related aspects broadly support success factors for performance. Generally, factors referring to collaboration-related skills were mentioned most frequently. The success factors align with the empathy categories from the research model (Figure 1): Team empathy aligns with *Team collaboration*; Interdisciplinary empathy corresponds with *Integration of disciplines*; and Interorganisational empathy with *Collaboration owner-contractor* and *Integration of stakeholders' interests*. *Openness* was not included in the research model as a success factor. However, the positive correlation between openness and empathy has been demonstrated in the literature (Roberge, 2013; Kouprie and Sleeswijk Visser, 2009). In conclusion, the critical success factors for project performance are, to some extent, conditioned by the empathic abilities of the team's participants in the integrated design phase.

After introducing the concept of empathy, in the second part of the interview, the interviewees indicated how, when and for whom empathy might be important during the integrated design phase. The interviewees' statements are clustered in Table 2 along with the three empathy categories:

(1) team empathy;
(2) interdisciplinary empathy; and
(3) interorganisational empathy.

Table 1. Concepts of success factors derived from the interviews and substantiated by the interviewees' quotes

Concepts → Interviewees ↓	Collaboration owner–contractor	Integration of disciplines	Team collaboration	Integration of stakeholder's interests	Openness
Interviewee 1	*"that the contractor and the owner **understand what each other's interests are**";* *"that the contractor is sufficiently skilled to communicate what is needed for a contractual change, such that it is clear for the owner, and that he **understands what the owner needs** as substantiation"*	*"both teams should feel along with each other and be able to talk to each other";* *"the construction team needs to be able to think along with the design team"* *"that you have a good collaboration between the design team and the execution team"*			
Interviewee 2	*"that **the contractor better envisions what the owner wants** in the design";* *"by communicating getting a better vision of what you expect from each other"; "that **the owner creates understanding** for how we did certain things"*	*"It is important to **delve into what's going on**";* *"start the conversation with project participants to hear the story behind certain choices";* *"They need to look at other layers in the organisation and **think about why this person did this**";* *"**To see why** certain choices are made and how things are integrated";* *"That the director or project board is open to signals in the organisation*	*"if you have a good team, with good dynamics and solidarity, where people know how to find each other, then you have good communication, which is essential"*		*"Be more open with each other and talk more to each other"*

(*continued*)

Table 1.

Concepts → Interviewees ↓	Collaboration owner–contractor	Integration of disciplines	Team collaboration	Integration of stakeholder's interests	Openness
Interviewee 3		*"I need to be able to communicate interests and involve people in why we go a certain way"*	*"If people are not able to find each other, everything will fail";* *"people need to be proud and enjoy their work";* *"if you can respect each other and the other's personality you can build together";* *"you need to see that you cannot change someone else but you can adapt to someone, then you can connect further and talk about the content"*		*"There needs to be openness"*
Interviewee 4	*"**empathising with the interests of the other** in the collaboration between owner and contractor";* *"it is about **interests** and being able to take perspective";* *"the owner has not enough perspective for the effect of his decisions";* *"that the owner realises how you need to communicate his request to the market parties";* *"that **a market party fathoms the owner's wishes**"*			*"we need to think about the image towards stakeholders"*	

(*continued*)

Table 1.

Concepts → Interviewees ↓	Collaboration owner–contractor	Integration of disciplines	Team collaboration	Integration of stakeholder's interests	Openness
Interviewee 5	*"on a management level it is about **thinking about the interests** of the project and not only individual interests"*		*"daring to ask for help in a collaboration";* *"It is about how do I function in a team?";* *"to be able to get the right culture and values within the team";* *"you can say anything as long as it is in a respectful way";* *"take a different perspective and help each other more. This supports more interaction, knowledge sharing, a high engagement of people and people feel more heard and welcome"*		*"openness is also very important"*
Interviewee 6	*"when you find dilemma's you need to be able to find each other and collaborate";* *"It's important there's trust and **seeing each other's interests**";* *"The owner needs to be involved in the project";* *"operate in **a triangle of the interests of the contractor, the owner, and the stakeholders**"*			*"operate in **a triangle between the interests of the contractor, the owner, and stakeholders"***	

(*continued*)

Table 1.

Concepts → Interviewees ↓	Collaboration owner–contractor	Integration of disciplines	Team collaboration	Integration of stakeholder's interests	Openness
Interviewee 7	*"Dare to act vulnerable and tell what's wrong";* *"That the contractor sees that the owner envisioned something";* *"Start the conversation together and feel comfortable to say what holds you back";* *"You need to get to know each other"*				*"Start the conversation together and feel comfortable to say what holds you back"*
Interviewee 8	*"that, together as a team from the client and contractor, you share ideas and discuss risks";* *"It is about acting vulnerable, openness, sharing problems and dare to speak";* *"it is about choosing people on competences instead of technical knowledge only";* *"also on the personal side we need to connect"*				*"always tell what's on your mind so we can talk about it together";* *"it is extra important to put energy in openness"*
Interviewee 9		*"it is essential you are* ***open to the different interests*** *and disciplines and that you deliver the project together";* *"you need to look broader and stay on speaking terms"*			*"you need to be open and transparently make clear what's going on"*

(*continued*)

Table 1.

Concepts → Interviewees ↓	Collaboration owner–contractor	Integration of disciplines	Team collaboration	Integration of stakeholder's interests	Openness
Interviewee 10	*"it is important you can have informal meetings where you can speak freely, specifically between owner and contractor"*	*"it is important you* ***consider all different interests****, requirements and processes in a project";* *"don't look at matters separately but have a more broad perspective and look at relationships between matters";* *"it is about the interference between other processes and interfaces"*			*"it is important you can have an informal meeting where you can speak freely"*
Interviewee 11	*"it is about the collaboration and the attitude of both parties when unforeseen circumstances take place"*				*"when you collaborate, you should be open and direct from the beginning"*

Source: Authors' own creation

Interviewee	Empathy is most important during the integrated design phase to foster project performance . . .	1	2	3
1	Between participants from the design team and construction team to support good collaboration and integration between these disciplines		x	
2	Within teams to support job satisfaction of participants in the project organisation. Participants who enjoy their work and their colleagues are more productive, which supports project performance	x		
3	Within teams to involve participants and towards stakeholders	x		x
4	(I) For the project management, (II) towards the owner, (III) for stakeholder manager and towards stakeholders and (IV) for contract management		x	x
5	(I) Within teams and towards the owner, and (II) between participants from the design team and construction team to support a good collaboration and integration between these disciplines	x	x	x
6	Between the owner and contractor			x
7	Between the owner and contractor in the tender phase because that is where good collaboration starts			x
8	Between the owner and contractor			x
9	(I) Between the owner and contractor (especially during the tender phase), and (II) between participants from different disciplines		x	x
10	Between the owner and contractor			x
11	Between the owner and contractor			x

Source: Authors' own creation

Table 2. For whom is empathy important during the integrated design process and for project performance

Table 2 shows that empathy is considered necessary at every level. However, external interorganisational empathy between the owner and the contractor was scored as the most relevant. Delving deeper into the interview data, we observe the following about how, when and for whom empathy is relevant to support performance. The arrows indicate the empathic interaction. Verbatim quotes from the interviewees are indicated in *italics* and placed between quote marks:

(1) Team empathy – Internal empathy

- *Team members ↔ Team members*

  The interviewees elaborated on the contribution of empathy in the entire team to a productive and successful project organisation in which the participants are "happy and satisfied with their job". When team members are more empathic towards each other, "trust and a certain level of solidarity is created". Consequently, "team members are more satisfied with their job and colleagues", which improves productivity and involvement. Then, by being empathic, "team members understand how to communicate with each other, which contributes to collaboration within the team".

- *Project Managers → Team members*

  Team members need to be empathic towards each other, but it is their managers in particular who should "stimulate and facilitate this by leading by example". Managers should know how to "involve and stimulate team members and be aware of the personalities and behaviour of the participants to encourage them to share their ideas so that the project can benefit from them". Furthermore, managers should be empathic "to understand how to communicate plans to their team members" so that they "feel more involved, welcome and heard", making them more productive as a result.

(2) Interdisciplinary empathy – Internal + external empathy

- *Participants from discipline A ↔ Participants from discipline B*

  Interviewees explained that empathic abilities are needed to "acknowledge the other's different expertise and personality" and to "empathise with someone else's way of thinking and working, and with their interests and problems". Being empathic can support a good project outcome by "understanding how to communicate with someone from another discipline and creating trust. It is about understanding each other", "understanding how to communicate information between disciplines" and "being able to share ideas with the other person to support collaboration and integration between the disciplines" and "to achieve a joint success".

- *Team members of the design team ↔ Team members of the execution team; Managers and team leaders of the design team ↔ Managers and team leaders of the execution team*

  The interviewees stated that participants from the design and construction teams in particular not only have different expertise but also "have different characters and communicate in different ways" Empathy promotes "listening to each other, instead of pushing your own opinion". It is needed "to understand and sense what kind of communication is needed" when working with someone from a different discipline and "to understand the other's process and challenges", because collaboration between the design and construction team is considered crucial for performance in today's projects. This is considered primarily the responsibility of the managers and team leaders.

- *Project managers and team leaders of disciplines → Participants from other disciplines*

  In particular, the interviewees allocated a role to the project managers and the team leaders of the disciplines to be empathic towards each other and to stimulate empathy between the disciplines. They should understand how to communicate "the interests of the project as well as the specific disciplines, and how to involve people". The interviewees also mentioned the importance of the project manager leading by example when it comes to empathy to create a "culture of openness in the organisation".

(3) Interorganisational empathy – External empathy

- *Owner ↔ Contractor (mainly the project managers of the two)*

  Most interviewees mentioned that the owner and the contractor should be mutually open and willing. This was mainly seen as the responsibility of the project managers. They should "understand each other's interests" and know how to communicate with each other, "to be aware of how my comments and questions are perceived by my counterpart". A lack of empathy towards the other to understand what is possible, feasible or reasonable for the other party leads to "unrealistic expectations, resulting in changes to plans and budget and time overruns". It was stressed that, especially at the beginning of the project, empathy plays an important role in building "mutual trust and understanding of each other's perspective" to prevent the project from getting off to the wrong start. Therefore, empathy

between the owner and the contractor is already crucial at the tender stage to understand each other's needs and challenges.

- *Contract managers owner ↔ Contract managers contractor*
  The interviewees also indicated that contract managers should empathise to "understand how to communicate contractual issues", "understand what language to use in the contract" and "to avoid their statements offending the owner".
- *Stakeholder managers → Stakeholders*
  The interviewees indicated that it is essential for stakeholder managers to be empathic towards stakeholders to "identify and respect their expectations, wishes, concerns and thoughts about the project", so that they can decide how to involve them and incorporate their interests in the design process. Interviewees pointed out that this should be on the agenda in the early stages of the integrated design process. "For most stakeholders who oppose a project, simply feeling heard and understood can be enough". In case the project lacks empathy towards external stakeholders, the interviewees explained that resistance to the project would grow, permits might not be granted, the project might receive negative media coverage, processes would be disrupted and, ultimately, the project might overrun budgets and time schedules.

It was concluded that, to a certain extent, empathy is essential for every team participant to function well in a team (team empathy). However, empathy is considered most important for project managers, team leaders of the disciplines, contract managers and stakeholder managers. These project roles have in common that they have a lot of contact with external parties (interorganisational empathy). Empathy was considered less important for participants from the Project Control – Finance team and participants lower down in the organisational structure, especially participants from the Technical Management team. This could be explained by the less integrative character of their tasks and fewer external contacts.

In summary, the analysis of the interview data shows that empathic abilities support performance and that empathic abilities are considered most important for participants with integrative tasks, although empathic abilities are to some extent important for any project participant.

5.2. Part II: empathy measurement

In addition to measuring the team's empathy, a literature review was conducted of studies on empathy using the IRI method to gain a broader picture of empathy levels and to be able to put the project team measurement in a broader context. The IRI method is widely used in the fields of psychology and sociology. However, studies often focus on groups with specific characteristics (e.g. schizophrenia, autism) or samples from psychology and medicine students or academics. For this study, only samples without specific characteristics (e.g. control groups) were used so that a reasonable comparison could be made with the project team used in this study. Table 3 presents the IRI measurements found in the literature and the empathy measurements of this study. Only the samples highlighted in green in the table were used for the analysis (4,184 participants, 58% of whom were female). The literature review indicates an average level of empathy of 63.6, with a significant difference between the genders (females 67.5; males 59.1). An equal ratio of females to males would result in an

Name	Year	Country	Sample characteristics	Total						Male						Female						
				N	Total	FS	PT	EC	PD	N	Av. Age	Total	FS	PT	EC	PD	N	Av. Age	Total	FS	PT	EC	PD
Corte *et al.*	2007	Belgium	Recruitment via advertisements in Magazines (13%), snowball sampling from initial recruitment by research assistants (87%)	651	63.7	16.5	17.3	18.1	11.9	299	25	57.7	14.5	16.4	16.6	10.26	352	28	69.1	18.2	18.0	19.6	13.3
Hirvela and Helkema	2011	Finland	Control Group, 61 female (37%), 78 male (76%), recruited via snowball and Facebook advertisement	139	62.8	16.9	17.0	18.9	10.0														
			Asperger group 23 female (34%), 18 male (31%)	41	56.4	13.6	14.5	15.6	12.8														
Ewin *et al*	2021	Australia	Project management master students, 18-44 yr, 18% female	149	65.3	16.5	17.7	17.7	13.4														
			Nursing Students	-	76.1	19.3	19.8	20.6	16.4														
			Medical Students	-	79.9	18.1	19.4	20.9	17.6														
			Medical Students	-	-	-	20.3	21.5	14.9														
Cothera et al	2013	USA	Schizophrenia patients	30	50.8	13.4	16.1	18.5	11.8														
			Healthy control group, recruited through advertisements (flyers, internet posts) and selected to match the racial, age, and gender composition of the patient sample. 9 females (total av. age 40	24	62.1	13.8	19.1	20.0	9.2														
Hank *et al*	2012	The Netherlands	Middle-to-early adolescence, 12-16 years old, and late (av. age 17.8yr, sample 2) adolescents, randomly recruited from elementary schools and high schools														501	Sample 1: 45yr. Sample 2: 48yr					
			Early adolescents	269	61.7	15.5	14.5	17.6	14.0	148	13.0	56.7	14.0	13.9	16.1	12.7	121	13.0	65.9	16.8	15.1	18.8	15.2
			Late Adolescents	232	62.5	16.7	16.6	17.8	11.5	107	17.8	55.1	14.5	15.4	16.0	9.3	125	17.8	68.8	18.7	17.6	19.3	13.3
Fernandez *et al*	2011	Chile	Undergraduates from different fields (engineering, psychology, journalism, accounting, and advertising)	435	63.0	15.4	16.9	18.4	12.2	201	18-36; av. 20	59.0	14.1	16.6	17.2	11.10	234	18-36; av. 20	66.4	16.5	17.3	19.4	13.2
Lachman *et al*	2018	China, Germany	University of Electronic Science and Technology, Chengdu, 59.1% Baccalaureate-Diploma, 40.9% a university degree	612	61.0	15.8	15.8	17.7	11.7	450	18-32	60.5	15.6	16.0	17.5	11.42	162	18-32	62.5	16.3	15.3	18.3	12.5
			Most participants recruited from Ulm University, Germany, remaining participants were adults recruited from the general community in Germany, 70% Baccalaureate, 25% university degree	304	69.5	18.8	17.8	19.6	13.3	97	18-63	62.4	16.7	17.3	17.3	11.04	207	18-63	72.8	19.8	18.0	20.7	14.4
Guadagni *et al*	2020	Canada	Volunteers recruited through the University of Calgary Research Participation System and COVID-19 research page, social media and word of mouth	573	63.8	15.3	15.8	20.2	11.0	112	26	54.7	13.0	14.6	17.3	8.80	459	26	65.9	15.9	16.1	20.8	11.5
Larson *et al.*	2010		Sample of healthy, age 18-30yr, 57% female, recruited from advertisements in the local community and undergraduate psychology courses.	30	62.8	17.7	14.6	20.8	9.8														
Gould and Gautreau	2014	Canada	University undergraduates introductory psychology classes, av. age 19.5yr, 66%	144	66.8	17.3	18.1	19.4	12.0														
			Older adults, av. age 68.75yr, 75% female, recruited through public service announcements	120	63.5	13.1	18.7	21.3	10.4														
Sinderman *et al*	2019	Germany	Sample from Ulm University, outliers excluded	1098	68.5	18.7	17.3	19.1	13.5	304	18-30yr; av. 21.9	60.6	16.4	16.6	16.4	11.24	794	18-30yr; av. 21.9	71.6	19.6	17.6	20.1	14.4
Kuis *et al.*	2021	The Netherlands	Dutch control group, recruited via social media, local schools, flyers; 71% male, av. 36.1yr.	49	56.4	13.1	17.1	17.0	9.2														
			Ultra high risk Psychosis group, 44% male, 22.1yr	43	60.9	17.0	13.7	16.1	14.1														
			Schizophrenia spectrum disorder group, 66% male, 38.9yr	92	61.9	13.8	16.5	18.0	13.7														
Average			Averages of green marked samples (totals include 58% females)	4184	63.6	15.9	17.2	19.1	11.3	1463		59.1	15.0	16.2	17.1	10.64	2709		67.5	17.7	17.0	19.8	13.2
2021	The Netherlands	Project team members of the present study	219	57.2	12.8	18.2	16.7	9.5	185		55.5	12.1	18.1	16.2	9.17	34		66.2	16.8	19.0	19.0	11.4

Source: Authors' own creation

Table 3.
Levels of empathic ability derived from studies using the IRI test and this study

average level of empathy of 63.3 in the literature. Although an extensive literature review is beyond the scope of this research, some noteworthy observations can be made.

The project team in this study had an average empathy level of 57.2 (females 66.2; males 55.5), which is 10% lower than the average in the literature. This gap can be explained by the overrepresentation of men in the project team (34 females, 185 males), which is typical for the civil engineering industry. However, it is also noted that the average empathy level of the males in the project team is lower than the average found in the literature (literature 59.1; project team 55.5). For females, the project team's average is slightly lower than the average from the literature (literature 67.5; project team 66.2).

From a historical perspective, the relatively low levels of empathic ability can be explained by the nature of the relationships, for instance, between owner, contractor and subcontractors, which were based on pricing and "the lowest bidder wins" (Butler and Chinowsky, 2006). In such cases, interpersonal relationships and empathy are not the main drivers of project success. The transition to integrative and collaborative projects and contracts justifies a focus on other competencies such as empathy, as evidenced by the interview data (see Table 1).

Diving into the four IRI dimensions, it is noted that the lower levels of empathy of the project team are driven by lower scores for FS, EC and PD. The PT scores are higher than the averages from the literature. This suggests that relatively low affective empathic abilities drive the project team's lower overall empathy scores. Where women of the project team score 20% higher than men on affective abilities (EC + PD), they score only 5% higher on the cognitive abilities (PT), indicating that higher women's empathic abilities are driven by higher affection. These results may reflect the construction industry's culture of "getting things done", "results first" and focusing on progress. Such a culture might also be conditional for success and could even be hindered by affection (Bloom, 2018). So, the significance of the relatively low affective empathic ability in a changing civil engineering industry needs more study.

The data were also analysed for group characteristics. The owner's team scores significantly higher on empathy than the contractor (owner 65.2; contractor 56.2). The owner's team consisted of 32% females, and the contractor's team consisted of 13% females, which partly explains the difference. The owner's team scored higher than the literature's average (63.3), whereas the contractor's team scored significantly lower.

5.3 Merging the results of Parts I and II

The analysis of the interview data showed that empathy positively supports the most critical success factors for project performance during the integrated design phase. However, the measurement shows that the project team's level of empathy is relatively low compared to the averages found in the literature (project team 57.2; the literature 63.3). Although more research is needed to investigate the significance of such a gap, the difference is considered remarkable. Given the relatively high level of empathy of women, the data suggest that project performance can be improved by increasing the gender diversity of project teams. The positive correlation of gender balance with performance of project-based organisations is demonstrated in the literature and is driven by factors such as team cohesiveness, collaboration, adaptability and customer service (Baker *et al.*, 2019). Empathy is an ability that supports these success factors.

Furthermore, the interviews revealed the project roles and disciplines for which empathy is especially important, see Section 5.1. By combining these findings with the empathy measurement for these disciplines, it can be verified whether the empathy levels are in line with expectations, see Table 4.

The figures indicate that the empathy levels of contract managers and stakeholder managers are relatively high, which corresponds with the statements of the interviewees. According to the interviewees, project managers and discipline team leaders should score high on empathy. They were held responsible for interacting with other organisations and stakeholders, supervising their teams and getting their teams to collaborate effectively. All participants supervising more than ten people were checked to verify this group. This part of the sample scored 53.1 ($N = 22$) on average, which is relatively low.

Participants of the Project Control – Finance group scored low, which corresponds to the importance of empathy that the interviewees ascribed to this group. This confirms that for some project roles empathy will not be an essential competence or may even be counterproductive. For the participants lower in the organisational structure, the group of participants that had no supervision was verified. This group scored 58.4 ($N = 149$), which is higher than the team average. Although empathy was considered less important for this group, the relatively high level of empathy can be valued positively because empathy was considered to some extent relevant for the whole team. Nevertheless, it is noteworthy that this group scored higher than the project managers, who were expected to score highest.

The importance of empathy for project management and performance that emerged from the interview data is supported by the literature, which emphasises in particular the relationship between empathy and transformational leadership. A transformational leader is defined as a leader who increases the trust of individuals or groups and focuses on exchanging subordinates' needs and interests (Butler and Chinowsky, 2006; Toor and Ofori, 2008). The integration challenges of today's projects and, in particular, the integrated design phase require transformational leadership. Given the relatively low levels of empathic ability of the project managers and discipline team leaders, there is scope to improve performance by increasing the empathic abilities of this group.

5.4 Limitations of the study

As this is the first study to examine the interaction of empathy in the field of civil engineering, there are a few limitations to the research. Firstly, only one project was used to collect the data. Therefore, more multiple case studies are recommended to strengthen generalisation. In addition, the data were collected through interviews with people who may have lacked a clear understanding of what empathy is. During the interviews, it became evident that empathy is a complex concept for people to fully understand. Furthermore, the method used to measure empathy has some limitations. A self-assessment requires a certain

Average level of empathic ability of the project team: 57.2

Empathic ability is important		Empathic ability is less important	
Role	Empathy	Role	Empathy
Project managers and team leaders of the disciplines	53.1	Project Control – Finance	48.3
Contract managers	65.6	Participants low in the organisational structure	58.4
Stakeholder managers	61.1		

Note: Figures in red deviate from the expectations
Source: Authors' own creation

Table 4. Combination of the interview data and the empathy measurement data per role and discipline

degree of self-knowledge of the respondents and some commented that they found the questions used in the IRI test rather difficult to understand. Because this study used relative levels of empathy, this limitation is considered minimal. Finally, there was a low response rate for some specific disciplines. Therefore, these groups needed to be analysed with care.

6. Conclusion

In recent decades, civil engineering projects have had to contend with the increasing integration of stakeholder interests and disciplines. Given the current challenges of climate adaptation, circularity, biodiversity and increasing urbanisation, this trend is expected to continue. Changing project characteristics will affect the key competencies of project teams, because the crucial role of project team participants' competencies for project success is broadly accepted in the literature. Although research has demonstrated the positive contribution of empathy to team performance and design processes in general, the impact of the empathic abilities of project teams in civil engineering projects has not yet been studied.

This study investigated the role of empathy in a large infrastructure projects involving a high level of complexity in terms of integrating stakeholder interests and disciplines. Although empathy was identified as an important competence for project performance, the results indicate a relatively low level of empathy in the team, caused by low scores on affective abilities. Moreover, the team's project management, which was expected to score high on empathy, scored lower than the team's average.

The implications for practice are that there is potential for improvement of project performance by increasing the team's level of empathy, particularly that of the project management. Given the relatively high level of empathic abilities among women, mainly driven by higher affective abilities, this study suggests that performance can be improved by increasing the proportion of women in project teams, particularly in management roles of the project. The insights into the substantial difference in the level of empathic ability between women and men also contribute to the body of knowledge on the effects of gender diversity in the civil engineering sector and substantiate its interaction with project performance.

Although this study provides initial and important insights into the levels of empathic abilities, more research on project teams is needed to further generalise the levels of empathic ability in the civil engineering industry and its interaction with project performance. The significance of the gap between the expected and measured levels of empathy needs to be further understood, as balancing the need for more empathy resulting from integration challenges and maintaining a culture of "getting things done" is a point of attention.

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