Measuring Global Distance: A Survey of Distance Factors and Interventions

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***Abstract*—Geographic separation, lack of timezone overlap, and cultural differences are widely recognized as factors that impede communication and collaboration of globally distributed software development teams.**

While much research has been done into *how* these factors affect communication and collaboration, there needs to be a way of measuring *how much* affect they have.

This research attempts to quantify the effect of different factors along three dimensions of global distance: geographic, temporal, and cultural distance.

Thirty researchers and practitioners were asked to rate the degree to which 28 different distance factors affect communication and collaboration. The responses were aggregated and then used to calibrate a global distance metric. Then, the metric was used to measure the global distance among three teams engaged in distributed software development across Europe.

The study revealed some important insights into the impact of global distance, and the effects of different interventions designed to reduce that impact. In particular, survey participants considered transcontinental and intercontinental distances to have particularly high impact, perhaps because they also rated in-person face-to-face interactions as the most effective way to reduce impact.

The results of our study will prove useful for assessing the impact of global distance on software development projects, for evaluating different strategies for reducing that impact, and for calibrating software process models and frameworks.

***Keywords*—Global Software Engineering; Empirical Software Engineering; Metrics**

I. Introduction

Global Distance – geographic separation, lack of timezone overlap, and cultural differences among distributed software development teams – impedes communication among distributed software teams. Global distance prevents the kind of informal communication that can fill-in the gaps in specifications, designs, plans, and other formal communications.

The effect of global distance on communication and collaboration has been widely investigated [1–4]. Factors such as culture, language, distance, and time all contribute to communication barriers. However, less research has been devoted to measuring *how much* these various factors that comprise global distance affect communication and collaboration. For example, two teams that are part of the same company, working in San Francisco and Boston, will have relatively less difficulty collaborating than two teams located in Shanghai and Ireland, who are working for different companies.

How can we measure the relative impact of these factors on teams' ability to collaborate? And, how can we measure the degree to which various interventions, designed to reduce the impact of global distance, do, in fact, improve communication and collaboration?

In order to provide empirically grounded values for global distance factors and interventions, we designed a survey to elicit researcher and practitioner opinions on the impact of distance factors and interventions. Thirty researchers and practitioners were asked to rate the impact of each factor or intervention on a five-point scale, ranging from "Hardly at all" to "Very much."

The responses were then aggregated to create a metric for assessing the Global Distance between software development teams. Finally, we asked practitioners located in Spain, Germany, and the United Kingdom, to compute their global distances based on this metric.

The results revealed a surprising agreement among researchers and practitioners on the effect of different distance factors and interventions, lending credence to the resulting metric. The trial reveals a surprising disagreement between teams on the size of the distance between them.

The impact of these results is threefold.

First, project managers and team leaders can use an empirically-calibrated metric to gauge the global distance between collaborating teams. This is useful for allocating tasks to reduce communication overhead, and for planning interventions to reduce distance between teams that must communicate.

Second, researchers can use the results to calibrate models, such as a the project survivability model proposed by Avritzer and colleagues [5], or games such as GSD Sim [6], and to prioritize recommendations comprising process models for global software development.

Finally, the results make it possible to compare different interventions to reduce the effects of global distance.

In the next section we review some existing metrics related to global software development. Following that we present the method used to collect empirical data to calibrate the model. Then, we present a Global Distance metric that uses the empirical data to compute a value for Global Distance. Finally we discuss a case study of the model's application to a real-world situation, followed by conclusions and plans for future work.

TABLE I. Common Global Software Development issues.

Category	Example consequence
Global distance (geographic, temporal, cultural)	Lack of informal communication
Organization	Increased communication overhead
Management	Reporting delays; culturally inappropriate rewards
Process	Problems scaling co-located processes
Infrastructure	Tool mismatch among teams
Fear and Trust	Lack of communication

II. Background

More than a decade of global software engineering research has yielded numerous insights into the problems organizations encounter when moving to globally distributed software development. These can be classified broadly into a handful of categories, as shown in Table I [7] .

Research has revealed not only issues related to global software development, but also potential solutions [1]. For example, the Global Teaming Model [3] includes 70 practices based on empirical research that address management issues related to global software development. However, while the practices are known to be effective, based on evidence from case studies and other empirical investigation, the model does not include any metrics of how effective they are. As such, it is difficult to know how to prioritize implementation of practices. This is true of most process models related to global software development.

There have been some attempts to provide measures of effectiveness to aid in prioritizing process improvement efforts. For example, Aranda and colleagues [8] propose a selection strategy for choosing collaboration tools, based on the notion of "cognitive styles." Lasser and Heiss [9] developed a model that correlates collaboration maturity with an "offshoring cost barrier" that could be used to gauge an organizations' readiness to engage in global software development.

Herbsleb et al's [10] empirical study that evaluated the effect global distance has on timescales is possibly the first study to try to quantitatively assess issues associated with GSD. Using data from a change management system, they modelled the delays that can occur in the development lifecycle of GSD organizations. They report on a study of two geographically distributed organizations that focuses on the effects of geographic distribution on delay in the development life cycle. They also examine the patterns and quality of communication to shed light on possible causes of delay. Using two separate case studies they were able to collect two different measures of delay that allowed them to compare single-site work with distributed work.

Misra [11] developed a cognitive weight complexity metric (CWCM) for unit testing in a global software development environment. Although there doesn't appear to be a clear link between the metric and GSD, the author does suggest the metric is suited to GSD because there is reduced risk since the metric doesn't depend on the "language of code and programming style, nor is it affected by the loss of control, coordination problem."

Osho et al [12] built on Misra's model, and took heed of Herbsleb et al's findings that distance in GSD introduces delays, by focusing on the structure of the code, and coherence in particular. They created a coherence-collocation model that points to those parts of software that should be outsourced or handled by teams, partners or organizations "that guarantee collocation and full-allocation of developers." They claim that the model can be "optimized to determine the best mix of developers, since it utilises effort needed vis--vis the amount of developers available."

Walgers [13] developed the Problem Goal Pattern Measurement (PGPM) technique, based on the Goal Question Metric approach. Process patterns are used to generate general solutions found in the software development literature, where solutions are mapped to problems that occur during software development. This mapping of general proven solution to a given known problem helps ensure the right pattern is selected for use. The PGPM helps users to take a goal approach to problem areas requiring support. However, this technique has yet to be validated.

Taking an organizational perspective, Espinosa and Carmel [14] present a model for predicting costs based on several factors including collaboration structure, timezone overlap, and communication infrastructure. However, their model was not validated with empirical data. Similarly, social network analysis [15–17] has been used to gain insight into how successful GSD projects communicate. For example, Bird and colleagues developed and approach to predict faults in source code [18].

Socio-technical congruence, a metric that has emerged from this line of research, measures the degree to which an organization's communication structure matches the architecture of the product it is developing [19]. Metrics have been developed for measuring socio-technical congruence [20], as well as tools for improving congruence [21].

In summary, while there exist software process models and frameworks that organize practices to address most or all of the categories shown in Table I, there appears to be no corresponding metric or set of metrics to support prioritizing and measuring progress of implementation of those practices.

Toward that goal, we conducted an empirical study to address the following questions:

1) What is the *magnitude* of impact on communication and collaboration of factors that comprise global distance, such as geographic separation, lack of timezone overlap, and cultural differences?
2) What is the *magnitude* of mitigation resulting from interventions designed to reduce the impact of global distance?

In the next section, we describe our approach to answering these questions.

III. Method

What values should be assigned to capture the impact of distance factors and interventions? Geographic and temporal distance can be measured accurately, but the *impact* of increasing distance, for example, is not necessarily proportional to the distance value; rather, the impact is related to the *effort* required to visit a remote site. For example, one can visit a remote site that is an hour's flight in a single day, while a three hour flight may require an overnight stay. Similarly, sites in adjacent timezones are much "closer" temporally than sites across a continent.

Cultural distance is by nature qualitative; we consider China and Ireland to be further apart culturally than North America and Ireland, this difference is based on a qualitative comparison rather than a measurement. Interventions are likewise qualitative; the impact of interventions can be compared, but the exact value of each impact is difficult to assess.

Nevertheless, we need to assign values to distance factors and interventions in order to compute values for Global Distance that can be compared. As such, we chose an ordinal scale comprising five values to characterize the degree to which a factor increases, or intervention decreases, distance: "Not at all," "A little," "Moderately," "A lot," and "Very Much." Then, we asked researchers and practitioners involved in Global Software Development to rate distance factors and interventions using this scale.

The method we used to conduct this survey, and the results of the survey, are presented in the next sections.

A. Method

First, we designed a survey instrument to elicit opinions on the impact of distance factors and interventions. The survey comprised three parts:

1) A set of three questions asking respondents to rate the degree to which thirteen factors related to geographic distance, degree of timezone overlap, and cultural differences, increase global distance. Respondents were asked to use the five-point scale ranging from "Not at all" to "Very much" as described above to perform their rating.
2) A set of three questions asking respondents to rate the extent to which fifteen interventions reduce the impact of geographic, temporal, and cultural distance, again using the same five-point scale.
3) A set of five demographic questions about the respondent's role, background, and experience.

The entire survey is included in the Appendix.

Next, we solicited volunteers from the attendees at the International Conference on Global Software Development, held in Shanghai in August, 2014, to complete the survey.

Subsequently, we asked participants in a two-day workshop on collaboration across distance to complete the survey. This workshop was organized for employees of a multinational company that provides analytic services, and has software development teams across Europe.

Finally, we aggregated the responses to obtain impact values for each distance factor and intervention.

IV. Survey Results

A. Demographics

A total of 30 volunteers completed the survey; 15 researchers and practitioners attending ICGSE 2014 in Shanghai, and 15 participant in the collaboration workshop. Among the respondents, there were eleven academic researchers, four researchers working in industry, and fourteen practitioners. These figures are summarized in Table II.

TABLE II. Demographics of survey respondents.

Experience	Years
Average experience in GSD	7
Average total software engineering experience	14
Countries represented	10
(Pakistan, Brazil, New Zealand, Germany, USA, China, UK, Finland, Spain, France)	
Respondent Role	**Number**
Academic researcher	11
Industry researchver	4
Practitioner	14

TABLE III. Survey results.

Questions regarding *Distance Factors*	# Resp.	Median	Mode
How much do the following increase geographic distance?			
Different building on same campus	30	1	1
Different towns in same region (two hour drive)	30	2	2
Less than three hour flight (Frankfurt to Helsinki)	29	3	3
Transcontinental flight (New York to San Francisco)	30	4	4
Intercontinental flight (London to Shanghai)	30	4	4
How much do the following increase temporal distance?			
Transcontinental (five hour overlap)	30	1	0
Intercontinental (three or four hour overlap)	30	2	3
Global (one or two hour overlap)	30	3	4
No overlap	29	4	4
How much do the following increase cultural distance?			
Uneven language skills	28	2.5	3
East/West divide in culture	27	3	3
Different national culture	27	2	2
Different organizational culture	29	3	3
Questions regarding *Interventions*	# Resp.	Median	Mode
How much do the following reduce geographic distance?			
Face-to-face meetings (in-person or onsite)	30	4	4
Face-to-face meetings (via video)	30	3	3
Exchange program	27	3	4
Synchronous communication infrastructure	29	2	2
Support for video conferencing at all sites	27	2.5	3
Range of communication tools with different comm. modes	28	2	2
How much do the following reduce temporal distance?			
Relocate team(s) to adjacent time zones	24	2	2
Create bridging team(s)	19	2	2
Adopt Follow-the-Sun development	26	3	3
How much do the following reduce cultural distance?			
Face-to-face meetings (in-person or onsite)	30	3	4
Face-to-face meetings (via video)	30	2	2
Cultural Training	29	3	3
Cultural Liaison/Ambassador	28	3	3
Adopt low-context communication style	26	2	2
Reduce interaction between teams from different cultures	25	2	0

B. Ratings

Table IV shows the median and mode (most common) rating for the impact of distance factors on distance components.

Table III provides some useful insight into the effects of global distance. Respondents considered both transcontinental and intercontinental distance to increase geographic distance "very much," perhaps reflecting the fact that a flight longer than three hours is a full-day commitment requiring an overnight stay. In other words, there may be a distance threshold where significantly greater commitment is required to hold a face-to-face meeting.

A similar threshold appears to exist in timezone overlap: responses indicate a five hour overlap has little or no impact on distance, but if the overlap is reduced to four, the impact increases to "a lot." Respondents considered two or less hours of overlap to have the same impact as no overlap at all, affecting temporal distance "very much."

With one exception, results indicate that cultural factors increase cultural distance "a lot." The exception, curiously, is differences in national culture; respondents considered that this factor only increases cultural distance "moderately." This may be a consequence of the fact that nearly two-thirds (19) of respondents were from Europe, where the European Union and Eurozone have promoted increasing trans-national integration.

Regarding interventions, the notable result is the value respondents place on face-to-face interactions to address geographic separation. In-person interactions are considered most effective, with video conferencing next. Other communication infrastructure besides video is rated less impactful.

Also, respondents favor cultural interventions involving face-to-face interaction, such as exchange programs and cultural ambassadors. In the case of culture, however, in-person interactions are rated much higher than video interactions. While the results indicate video-conferencing can mitigate geographic distance "a lot," and cultural distance "moderately," it appears there is no substitute for in-person interaction. Numerous studies recommend holding face-to-face meetings, especially as a project "kick-off"; our survey results support this recommendation as highly effective.

In summary, our survey results indicate that transcontinental or greater separation has a high impact; the most effective way to reduce this impact is to facilitate in-person, face-to-face interactions among team members, via meetings and exchange programs. These in-person meetings should be supplemented with video conferencing.

Comparing the median and mode (most popular answer) for each item in Table III shows that there is remarkable agreement among survey respondents as to the impacts of distance factors and interventions. In only eight of 28 items did the mode differ from the median, and in all but one case the mode was higher than the median. The most controversial item appears to be the intervention of reducing interaction among teams in order to reduce the impact of cultural differences. It appears that our survey respondents are divided about whether it is effective to sidestep this problem by keeping culturally different teams apart; possibly, this is a reflection of the population from which the respondents were drawn, a population, by virtue of attending events such as ICGSE, that appears to value cross-cultural interaction.

V. Example: A Global Distance Metric

As part of an effort to develop a model to predict how long it would take for a global software development project to recover from an adverse event [5], we developed a measure of global distance based on three distance dimensions: geographic, temporal, and cultural distance. The global distance between two sites is then the *Euclidean Distance* calculated from the three dimensions:

$$D_{global} = \sqrt{D^2_{geographic} + D^2_{temporal} + D^2_{cultural}} \quad (1)$$

TABLE IV. Factors contributing to distance ($\mathcal{D}_c$).

j	Factors affecting geographic distance	$(d_{j,geographic})$
1	Different building on same campus	1
2	Different towns in same region (two hour drive)	2
3	Less than three hour flight (Frankfurt to Helsinki)	3
4	Transcontinental flight (New York to San Francisco)	4
5	Intercontinental flight (London to Shanghai)	4
j	Factors affecting temporal distance	$(d_{j,temporal})$
1	Transcontinental (five hour overlap)	0
2	Intercontinental (three or four hour overlap)	3
3	Global (one or two hour overlap)	4
4	No overlap	4
j	Factors affecting cultural distance	$(d_{j,cultural})$
1	Uneven language skills	3
2	East/West divide in culture	3
3	Different national culture	2
4	Different organizational culture	3

where D_c is the value of distance dimension $c \in \{geographic, temporal, cultural\}$.

The global distance metric was used in the survivabilty model to calculate the probability that communication among teams facing an adverse event is adequate to deal with that event.

A. Distance Factors

In Eq. (1), each dimension ($D_{geographic}$, $D_{temporal}$, and $D_{cultural}$) is, in turn, computed as the sum of the impacts of various distance factors such as degree of timezone overlap, language skills, cultural difference, and geographic separation:

$$D_c = \sum_{j \in \mathcal{D}_c} d_{c,j} \quad (2)$$

In this equation, $\mathcal{D}_c$ is the set of factors contributing to distance component c; $d_{c,j}$ is the impact value of a distance factor j along dimension c, such as geographic separation ($c = geographic$), degree of timezone overlap ($c = temporal$), extent of cultural differences ($c = cultural$), or competency in the project's *lingua franca* ($c = cultural$).

This metric has the potential to provide a way for a software project to assess the barriers between teams introduced by global distance, plan interventions to reduce those barriers, and measure the effect of improvement efforts intended to reduce global distance.

In order for the metric to be truly useful, however, the impact values should be based on empirical evidence, so that the resulting distance measure reflects current understanding of how distance, time, and culture affect collaboration.

Each distance factor has a value that reflects the degree to which the factor impedes communication and collaboration. We use the results of our survey to parameterize the global distance metric, by using the mode as the impact value for each factor; the result is shown in Table IV.

As an example, consider two teams in New York and London that are part of the same company. These teams would have intercontinental geographic distance ($d_{5,geographic} = 4$), intercontinental temporal distance ($d_{2,temporal} = 3$), different national cultures ($d_{3,cultural} = 2$), but would share a common

TABLE V. INTERVENTIONS THAT REDUCE DISTANCE ($\mathcal{I}_c$).

j	Interventions affecting geographic distance	($i_{j,geographic}$)
1	Face-to-face meetings (in-person or onsite)	4
2	Face-to-face meetings (via video)	3
3	Exchange program	4
4	Synchronous communication infrastructure	2
5	Support for video conferencing at all sites	3
6	Range of communication tools with different comm. modes	2
j	Interventions affecting temporal distance	($i_{j,temporal}$)
1	Relocate team(s) to adjacent time zones	2
2	Create bridging team(s)	2
3	Adopt Follow-the-Sun development	3
j	Interventions affecting cultural distance	($i_{j,cultural}$)
1	Face-to-face meetings (in-person or onsite)	4
2	Face-to-face meetings (via video)	2
3	Cultural Training	3
4	Cultural Liaison/Ambassador	3
5	Adopt low-context communication style	2
6	Reduce interaction between teams from different cultures	0

language and organizational culture. Thus, we would compute the Global Distance between them as:

$$\begin{aligned} D_{global} &= \sqrt{4^2+3^2+2^2} \\ &= \sqrt{29} = 5.4 \end{aligned} \quad (3)$$

B. Interventions

Interventions can reduce, but not completely eliminate, the effects of global distance. To account for the effect of interventions, Eq. (1) can be modified as follows:

$$D_{global} = \sqrt{\sum_c (D_c(1-I_c))^2} \quad (4)$$

where $c \in \{geographic, temporal, cultural\}$, and D_c are as above (Eq. (1)).

The impact of interventions I_c is a value between 0 and 1 computed according to the following formula:

$$I_c = \frac{\sum_{j\in\mathcal{I}_c} i_{j,c}}{C + \sum_{j\in\mathcal{I}_c} i_{j,c}} \quad (5)$$

where C is a constant, $\mathcal{I}_c$ is the set of interventions in category $c \in \{geographic, temporal, cultural\}$, and $i_{j,c}$ is the *impact* of if intervention j. The values of $i_{j,c}$ are shown in Table V.

To see how interventions might affect global distance according to Eq. (4), suppose our example project installs video conferencing faclities to hold regular face-to-face meetings. The impact $i_{2,geographic}$ on *geographic* distance is 3, and $i_{2,cultural}$ on *cultural* distance is 2. Setting constant C to 1, this yields the following values for I_c:

$$I_{geographic} = \frac{3}{1+3} = .75 \quad (6)$$

$$I_{cultural} = \frac{2}{1+2} = .67 \quad (7)$$

The resulting reduced global distance is:

$$\begin{aligned} D_{global} &= \sqrt{(4(1-.75))^2+(3)^2+(2(1-.67))^2} \\ &= \sqrt{1+9+.44} = 3.23 \end{aligned} \quad (8)$$

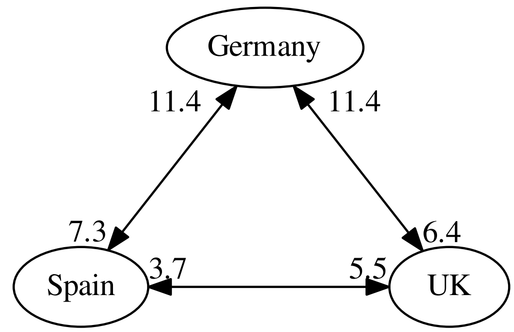

Fig. 1. Global distance among three distributed teams.

TABLE VI. GLOBAL DISTANCE METRICS BETWEEN PAIRS OF DISTRIBUTED TEAMS.

From	To:	Spain	Germany	UK
Spain		-	7.3	3.7
Germany		11.4	-	11.4
UK		5.47	6.4	-

Eq. (4), and Table IV and Table V, are used in the *GSD Sim* game [6] (Fig. 2) to determine how often the simulated project experiences problems, and the effect of interventions made by the player to reduce the occurrence of problems.

C. An Application of the Metric: Comparing Distributed Teams

To demonstrate the potential usefulness of the Global Distance metric, we conducted a trial to compare the Global Distance among three teams.

Participants in the workshop on collaboration across distance described in Section II represented three teams from across Europe: one in Spain, one in Germany, and one in the United Kingdom. We asked them to form three comprising members of teams at the same location. The groups were then tasked with computing their Global Distance to each of the other two teams, using the formula specified in Eq. (1).

All teams determined that geographic distance affected them "Moderately" (2), and temporal distance affected them "A little" (1). The main differences were in the way each team perceived the impact of cultural differences.

The results, depicted in Fig. 1 and Table VI are surprising in their asymmetry: the German team computed the same distance from both Spain and the UK; at 11.4 for each, this was the largest distance metric among the three. The Spanish team had the smallest distance to the UK, at 3.7; conversely, the British team computed their distance to the Spanish team at 5.5. The distance computed from the UK to Germany was 6.4, while the Spanish team put this value at 7.3.

Despite all team members being fluent English speakers, it's possible that the Spanish team felt closer to the UK team because one of the UK team members was a native Spanish speaker; this might mean they felt it was easier for them to communicate with the UK team, while the UK team had no such cultural "ambassador" on site in Spain.

The German team was part of a recent acquisition as so was new to the organizational culture. This might explain why they felt further apart culturally from their counterparts; the perception might have been from the opposite end that the German team was adapting well, while the German team might have perceived the transition as more difficult. It should be noted that one of the German team was a native English speaker, but language skills across the team were somewhat uneven.

Regardless of the root cause for the differences in perception, the fact that teams viewed their cultural distance differently is a signal for higher management that some interventions (such as the workshop the participants in this trial were attending) would be appropriate, to bring the teams closer together along the cultural dimension. An informal survey at the beginning of the workshop confirmed this: the overwhelming majority of attendees had meeting members of other teams as one of their objectives for the workshop.

VI. Conclusions

In this paper, we presented the results of a survey designed to assess the impact of various factors that contribute to, or help reduce, global distance in software development projects. We used these results to calibrate a global distance metric, that provides a comparative measure of the impact of distance on communication and collaboration.

Project managers and team leaders can use this metric to measure the global distance between collaborating teams. As shown in Section V-C, this metric can provide valuable insight into how teams perceive their counterparts; this insight would be invaluable when planning interventions to reduce distance between teams that must communicate and collaborate.

Second, researchers can use the results to calibrate models, such as the project survivability model proposed by Avritzer and colleagues [5]. Also, the values placed on different interventions can be used to prioritize recommendations comprising process models for global software development.

Finally, the results provide a way to compare the effect of different interventions an organization might take to reduce the effect of distance on a software development project. This is important because it allows an organization to assess the cost-effectiveness of different approaches to dealing with global distance.

Limitations

While our survey resulted in a significant number of responses (30 in total), the participants come from an "opportunistic" sample of conference and workshop attendees. While the respondents represent experienced researchers and practitioners with an interest as well as stake in issues related to global software development, there is the possibility of a hidden selection bias in the sample, since the respondents elected to attend each event voluntarily, and also participated in the survey voluntarily.

Nevertheless, based on their reported experience in software engineering in general, and global software engineering in particular, we feel respondents possess the necessary expertise to render informed opinions about the various factors and interventions.

Also, as noted in Section IV, Europe was disproportionately represented among the survey respondents; this might introduce an unidentified European bias to the results.

Finally, the metric presented in Section V provides a way to *rank* different scenarios involving global distance. However, the scale has not been calibrated, and so we cannot say with confidence *how much* greater one distance metric is over another.

Future Directions

As noted above, the global distance metric in Section V could be calibrated so that the values can be used to compare the actual differences between sites, rather than simply ranking them. This would be useful in the case presented in Section V-C, where the metric could be applied before and after taking steps to reduce the perceived cultural distance of the German team. A calibrated metric would show not only that improvement occurred, but also how much.

The survey population could be expanded to include more participants from outside Europe; North American and the Indian subcontinent, in particular, could have better representation in our sample.

Also, the number of factors and interventions could be expanded to include factors such as product architecture, organizational structure, and process.

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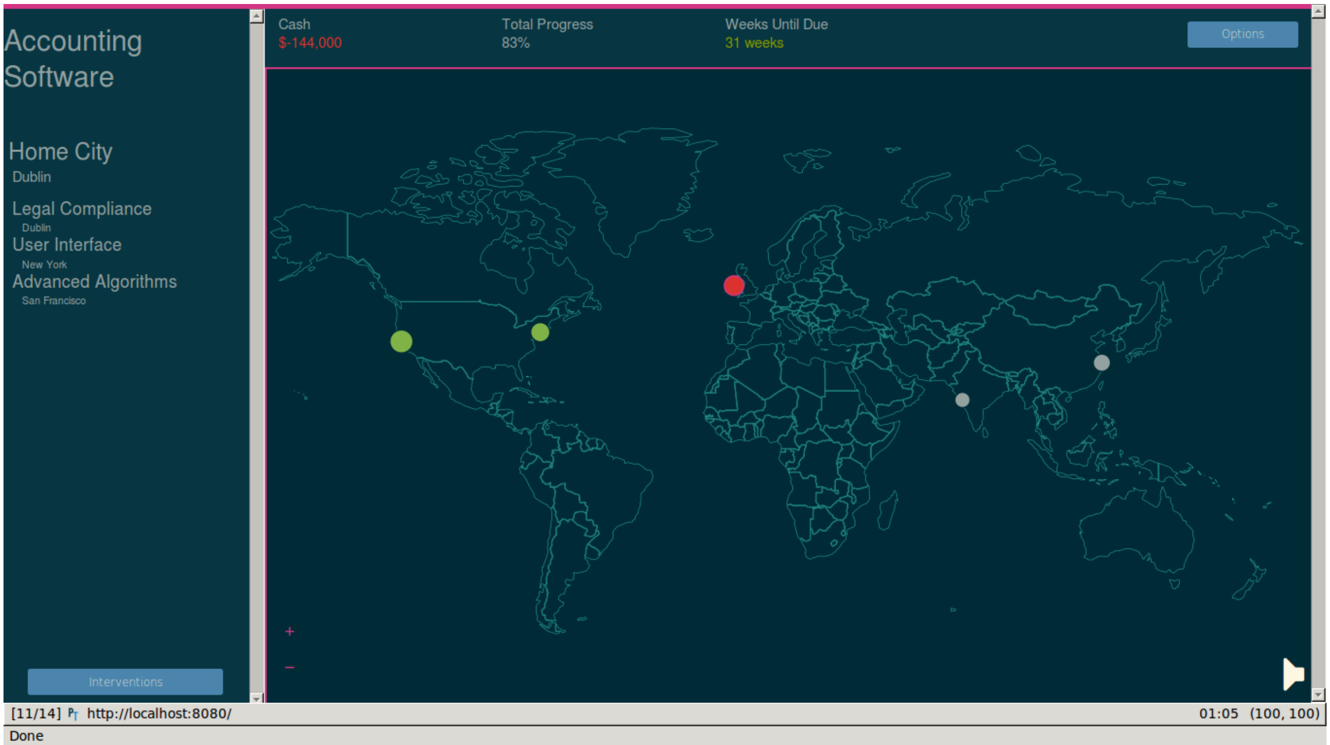

Fig. 2. GSD Sim simulation in progress. Green indicates sites are on schedule; red indicates the site has experienced a serious problem.

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Survey: Measuring Global Distance

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Geographic separation, lack of working day overlap, and cultural differences affect how well teams at different locations collaborate on a software development project. Taken together, we call these factors "Global Distance", which comprises three components: *geographic distance* (separation between sites), *temporal distance* (difference in timezones between sites), and *cultural distance* (difference in national, regional, and organizational culture between sites).

This survey has two objectives: 1) to assess the degree to which different factors increase Global Distance, and 2) to assess how different interventions reduce or mitigate Global Distance.

Please circle the number that best answers the question.

Distance Factors

How much do the following increase geographic distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Different building on same campus	0	1	2	3	4	X
Different towns in same region (two hour drive)	0	1	2	3	4	X
Less than three hour flight (Frankfurt to Helsinki)	0	1	2	3	4	X
Transcontinental flight (New York to San Francisco)	0	1	2	3	4	X
Intercontinental flight (London to Shanghai)	0	1	2	3	4	X
How much do the following increase temporal distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Transcontinental (five hour overlap)	0	1	2	3	4	X
Intercontinental (three or four hour overlap)	0	1	2	3	4	X
Global (one or two hour overlap)	0	1	2	3	4	X
No overlap	0	1	2	3	4	X
How much do the following increase cultural distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Uneven language skills	0	1	2	3	4	X
East/West divide in culture	0	1	2	3	4	X
Different national culture	0	1	2	3	4	X
Different organizational culture	0	1	2	3	4	X

Interventions

How much do the following reduce geographic distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Face-to-face meetings (in-person, onsite)	0	1	2	3	4	X
Face-to-face meetings (via video)	0	1	2	3	4	X
Exchange program	0	1	2	3	4	X
Synchronous communication infrastructure	0	1	2	3	4	X
Support for video conferencing at all sites	0	1	2	3	4	X
Range of communication tools with different comm. modes	0	1	2	3	4	X
How much do the following reduce temporal distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Relocate team(s) to adjacent time zones	0	1	2	3	4	X
Adopt Follow-the-Sun development	0	1	2	3	4	X
Create bridging team(s)	0	1	2	3	4	X
How much do the following reduce cultural distance?	Not at all	A little	Moderately	A lot	Very much	Don't Know
Face-to-face meetings (in-person, onsite)	0	1	2	3	4	X
Face-to-face meetings (via video)	0	1	2	3	4	X
Cultural Training	0	1	2	3	4	X
Cultural Liaison/Ambassador	0	1	2	3	4	X
Adopt low-context communication style	0	1	2	3	4	X
Reduce interaction between teams from different cultures	0	1	2	3	4	X

Demographic Information

The following information will allow us to see how point-of-view (experience, culture, and role) affects opinion.

Your role (please circle one): Academic researcher   Industry researcher   Practitioner
Your nationality:
Years of GSD experience (research and/or practice):
Total years of Software Engineering research/practice experience, including GSD experience:
Did you see Alberto's presentation on Survivability Models?   Yes   No