TASK DECOMPOSITION AND LEVEL OF COMPLEXITY TO SELECT THE CONTENT OF UNDERGROUND UTILITY NETWORK MODEL

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ABSTRACT:

Accurate and efficient 3D spatio-semantic Underground Utility Network (UUN) models looks indispensable for the whole cycle of its planning, construction, maintenance, and all kinds of the decision-making process. We do believe that UUN model should be able to provide multiple representations, considering data accessibility and model comprehensibility, but how to define these levels of detail (LoD)? In this research, we made the hypothesis that LoD selection is related to the complexity of task to be performed. This paper aims at designing a decomposition method of the decision-making task and defining the level of complexity to evaluate the task. Then based on the complexity level, select the content of UUN model that is most suitable for the task with the best representation. This paper discusses the possible connections between the LoD of 3D UUN model and with decision-making tasks, providing solutions to guide decisions of model selection.

1. INTRODUCTION

1.1 Context

Various applications of three-dimensional (3D) city model thrive in the urban planning, architecture, engineering, and construction (AEC) field (Biljecki et al., 2015). Among these, Underground Utility Network (UUN) is gaining growing attention, since they are the “lifeline” of an urban system, facing challenges in detecting, mapping, managing, etc (Lieberman and Ryan, 2017). They showed that huge quantity of subsurface facilities, lacking information, and ambiguous representations all stress up the management and maintenance work. Hence, accurate and efficient 3D spatio-semantic UUN models looks to be indispensable for the whole cycle of its planning, construction, maintenance, and all kinds of decision-making process. What should be their content? In 2021, we indicated that UUN model should be able to provide multiple representations, considering data accessibility and model comprehensibility (Chen et al., 2021).

In 3D city models, for outdoor and above-ground features, the Level of Detail (LoD) concept has been proposed, applied and developed (Biljecki et al., 2016, 2014a; Kolbe, 2009). It can provide the ability to describe the same reality with distinct and multiple levels of abstraction. However, for those underground, not visible but crucial facilities, the current UUN LoD application is not sufficient to meet the requirements. The definition for each possible level could still be vague and arbitrary (Becker et al., 2013; Biljecki et al., 2014b).

In previous works (Chen et al., 2021), a Multiple Level of Detail Approach (MLA) has been proposed to provide a solution to define possible LoDs for UUN (Figure 1). This MLA is defining UUN LoD based on decision-making tasks, identifying five key variables: geometry, topology, semantics, contextual information and semiology, to describe a 3D UUN model and derive the multiple LoDs. The multiple LoD system is defined based on the presence and attributes of these five variables (Figure 2). Through this MLA, a matrix of possible LoD could be obtained. Then after analyzing decision-making tasks, information needed for the tasks can lead to the minimum required LoD for performing certain tasks.

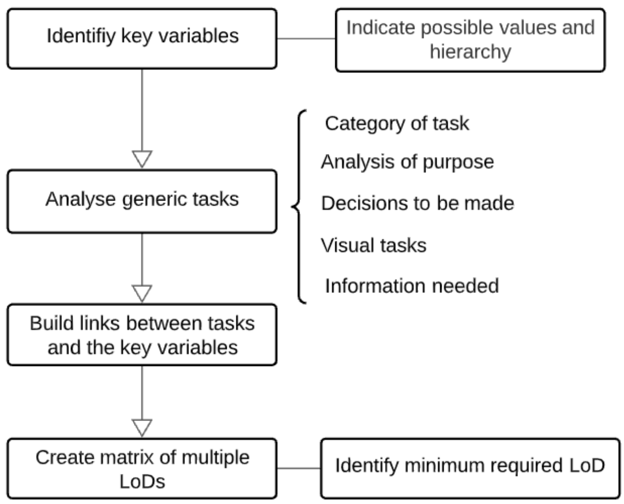

Figure 1. MLA design workflow (Chen et al., 2021)

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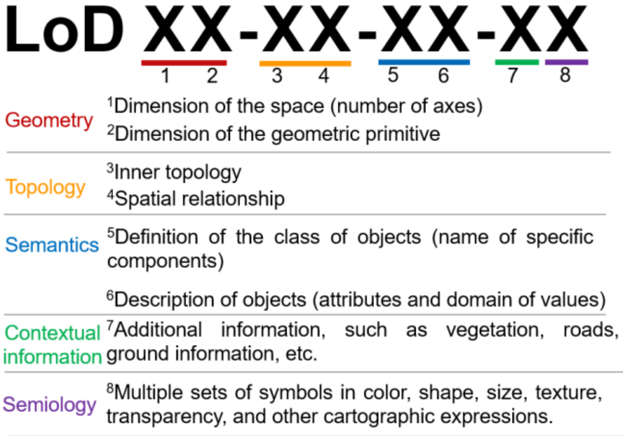

Figure 2. UUN LoD numbering system of MLA

1.2 Research objectives

The previous MLA is thus intended to provide possible links between the category of task and the definition of different LoDs. In Chen et al. (2021), this link was built manually. Now, with this paper, we are proposing an automatic process to build this link. In this research, the assumption is that the content of UUN model is decided based on the complexity of the task to be accomplished. In another word, an easy task does not require a complex 3D model to achieve and vice-versa. But what is the exact connection? This paper proposes some thoughts and results on this point. We have made the hypothesis that we can deduce the complexity of a task to be performed from the unique interpretation of the terms and concepts that compose the query. So the research presented in this paper aims at designing a decomposition method for the task and defining the level of complexity (LoC) to evaluate the task. Then the best LoD for solving a task could be found depending on the task and its LoC.

The main contribution of this paper is to associate decision-making task with the selection of UUN model content. The proposal of using task LoC to determine LoD is a novelty. It could answer the ambiguous problem of UUN LoD definition, and guide people to choose the suitable model for performing a task.

The following sections begin with a review of task decomposition and the criteria for evaluating task complexity in various fields. Then we present a method to decompose a decision-making task and to propose different levels of complexity of task. Finally, water network management and maintenance is chosen as the application domain, leading to final discussion and future work.

2. RELATED WORKS

Any kind of decision-making process, no matter is the application context, the stakeholder needs to perform what we can call a "task". A common definition for a task is "an activity performed to reach a certain goal" (Welie et al., 1998). When applying this definition in the context of 3D model, the concept of task can refer to any questions one might have, for which data manipulations, data queries, spatial analysis, are required. For instance, for the task "how many 3D buildings are located in the city of London, we would need to select the 3D buildings within the area that bounds the city of London. We can notice that there is a link between the question asked (the task) and the content of the 3D model, this is the basis of our approach.

In order to better understanding the scope of a task and subsequently define the required content of the 3D model, the literature propose to examine its composition and to categorize the tasks.

2.1 Task decomposition

Task decomposition has different meanings in many fields, such as robot systems, management, linguistics, and the geospatial industry. In a robot system, Albus (1993) decomposes tasks into three aspects: spatial decomposition, temporal decomposition, and execution. The frame of a task should contain name, goal, object, parameters, agents, requirements, and procedures. In the task allocation process for a man-machine system, Levis (1994) states that a three-level hierarchy of a task is to identify the component of functions. Likewise, Petrenko et al. (2021), propose to decompose a task into a group of elementary subtasks, then mapped to elementary operations in a multi-robotic system. In network management, Liu (2005) proposed an algorithm using control dependence and data dependence of a subtask to determine how the main task is decomposed. Zhang et al., (2021), brings up a way of decomposing and organizing complex task in the field of digital task management: a graph of task can be constructed by generating sub-task nodes and inferring temporal dependency (Figure 3).

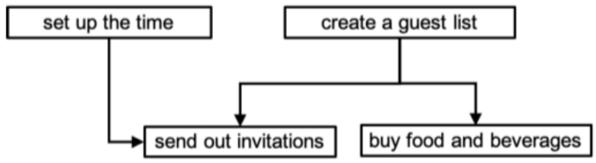

Figure 3. A subtask graph (nodes are subtask, directed edges represent the dependencies) (from Zhang et al., 2021)

In the industrial ergonomics field, Liu and Li (2012) put forward a general task model consisting of six inherent components: goal, input, process, output, time, and presentation. In the geospatial industry, some tasks are mainly about spatial query. Peachavanish et al., (2006) decompose queries into subqueries and translate them into spatial operations for data retrieval and analysis.

In summary, the research of task decomposition is mostly focused on how to find the sub-task and show its hierarchy. For defining LoD and solve meet the data requirements of decision-making tasks, more attention should be attached to the input and process of the task, and a targeted task decomposition method should be considered.

2.2 Complexity of tasks

To support a decision-making process, it is important to evaluate and categorize the task. A better categorization could improve work efficiency when solving similar demands. An evaluation of task could provide experiences and support for selecting suitable information sources. To evaluate and categorize tasks, there are different aspects, one of them is complexity (Liu and Li, 2011).

Considering the complexity of decision-making tasks, the concepts of complexity in relevant fields are investigated. According to Campbell (1988), the complexity of a task could have three primary properties: 1. information load, 2. information diversity, 3. rate of information change. Gill (2006) states task complexity has different definitions and can be grouped into five classes: experienced, information processing, problem space, structure and objective. In project management, the complexity could be structural, technical, temporal, and directional complexity, referring to the difficulty in managing interconnected activities, challenges in project design and technical details, uncertain environment, and in determining project goals and objectives (Remington et al., 2009). In a Geographical Information System (GIS)-based decision-making system, the complexity of a decision task could be information load, measured by the number of alternatives available for decision-making and the number of attributes that describe those alternatives (Jelokhani-Niaraki and Malczewski, 2015). Besides, there also exists the complexity of spatial data, graphic complexity of 3D model, the complexity of the man/machine interaction (Andrews, 2017). Ham (2012) implies that in human integrated systems, the task complexity have various perspectives, it is the combination of objective complexity and subjective complexity. Liu and Li (2012) has summarized different definition and forwarded that: “Task complexity is the aggregation of any intrinsic task characteristic that influences the performance of a task”.

To evaluate the task complexity, most of the research use a set of complexity factors to characterise the complexity. Robinson (2001) use a number of dimensions to describe the complexity (Figure 4). The “+” and “-” represents if the component is present or absent. In landscape architecture design, Steinitz (2008) proposed the level of complexity to show the level that the analytic methods underpinning any design must achieve (Figure 5).

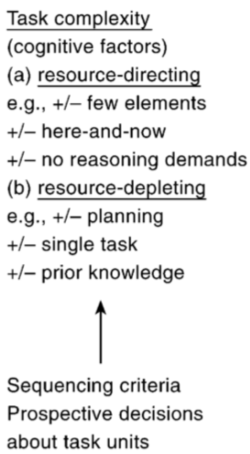

Figure 4. Task complexity dimension (from Robinson, 2001)

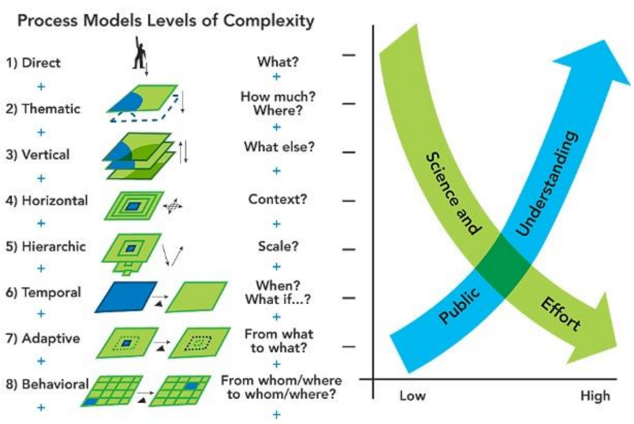

Figure 5. Level of complexity for landscape design (from Steinitz, 2008)

Braarud and Kirwan(2010) use eight dimensions to evaluate task complexity: ambiguity, spread/propagation, coordination requirements, information intensity, familiarity, knowledge, severity, and time pressure. Ham (2012) proposed three dimensions for evaluation: size, variety and order/organization, to consider the functional, behavioral and structural aspects of task. Factors such as number of variables, to collect, number of steps, and number of different types of control items are counted and calculated. Liu and Li (2012) intended to have ten dimensions to conceptualize task complexity (Figure 6).

Complexity dimensions.

Dimensions	Definition
Size	Number of task components.
Variety	Diversity in terms of the number of distinguishable and dissimilar task components.
Ambiguity	Degree of unclear, incomplete, or non-specific task components.
Relationship	Interdependency (e.g., conflict, redundancy, dependency) between task components.
Variability	Changes or unstable characteristics of task components.
Unreliability	Inaccurate and misleading information.
Novelty	Appearance of novel, irregular and non-routine events (e.g., interruption) or tasks that are not performed with regularity.
Incongruity	Inconsistency, mismatch, incompatibility, and heterogeneity of task components.
Action complexity	Cognitive and physical requirements inherent in human actions during the performance of a task
Temporal demand	Task requirement caused by time pressure, concurrency between tasks and between presentations, or other time-related constraints.

Figure 6 . Ten dimensions to evaluate task complexity (from Liu and Li, 2012)

After reviewing various concepts and evaluation dimensions of task complexity, considering the goal of linking LoD with different categories of tasks, the decomposition is aligned with Multiple UUN LoD design, and the complexity level is determined by each task component in this paper.

3. DECOMPOSITION OF TASK

To link the task with UUN LoD in our MLA, a corresponding task structure is thus proposed. Taking the task structure model in the reviewed literature, it is noticed that the objective, input, requirement, functional process, and how the result is presented are the important elements of a task. Therefore, in this task decomposition method, similar aspects are to be divided and converted.

Thinking about how a task is accomplished, a task first has a subject to identify who is carrying it out. Then decompose the verb indicating what people should do, and what actions are needed. Next, the object should be illustrated. Normally, a task may have specific conditions to limit the possible answers. Meanwhile, in a task, there could also be some supplementary information to make sure the requirements are well understood.

Consequently, a task can be divided into five major components: (1) Subject, (2) Verb, (3) Object, (4) Condition and (5) any supplementary information. To investigate further about the concept of object, for task involving UUN and spatial requirements, we propose to divide the concept of object into three types: (3.1) Component: explaining what the exact subpart are of the wanted object, (3.2) Relationship: showing involved different objects, (3.3) Property: obtaining the attributes of object. Figure 7 shows the final structure to decompose a decision-making.

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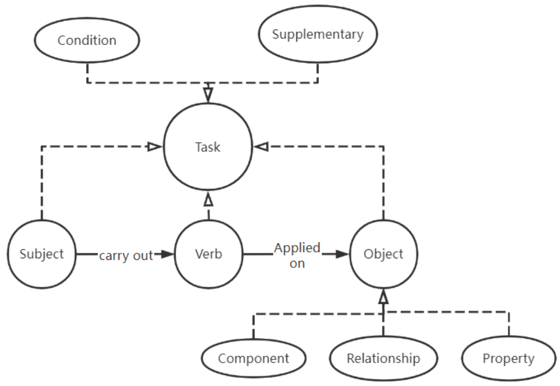


Figure 7. Structure of a decision-making task

To better illustrate the task decomposition, the decomposition of the task "Planners identify the vertical position of a control valve connected to main pipe No.107 under the roads" is an example: Subject as planner, verb as identify, object consists of valve as component, vertical position (z value) as property, and with one attribute condition: type = control valve, one spatial condition: connected to pipe No.107, and the supplementary information: under the road.

4. DEFINE LEVEL OF COMPLEXITY

After having the task decomposed as proposed in Figure 7, a method evaluating the complexity of task is proposed. Combing ideas from mentioned literature, the notion of complexity refers to information load (how much data this task needs) and operations (how many operations are needed) with specific indicators (how it is measured). To evaluate this task complexity, a "Level of Complexity (LoC)" is introduced.

Digging into the five task components, seven dimensions are acquired to indicate the measurement of complexity value (see Table 1). We decided to focus on quantifiable indicators, and for the first version of the method, we have made the hypothesis that the more elements are present, the greater the complexity and that all dimensions have the same impact on the complexity of a task.

Task component		Indicator
Verb (1 to 4)		number of containing semantic meanings
object	Component (1 to 4)	number of UUN classes
		number of subdivisions
	Property (0 to 4)	number of attributions
	Relationship (0 to 4)	number of other involved objects
Condition (0 to 4)		number of needed spatial operations
Supplementary (0 to 4)		number of information kinds other than UUN

Table 1. Task complexity indicators and possible valves.

For the verb component, the indicator refers to the number of semantic meanings, indicating how many actions it requires. For the object component, indicators are the number of components, number of subdivisions, number of aggregated attributions and number of other involved objects. For condition component, the number of needed spatial operations is used as an indicator. For supplementary component, number of information kinds other than UUN is the evaluation measurement. In this way, the task complexity evaluation dimensions are established. The protentional complexity hierarchy is lying in the increasing indicator values. The possible values are estimated based on our experiment and literature review. We estimated that in a normal composition of a task sentence, it is almost impossible to state more than four items per component of the task sentence. Consequently, for indicators of verb and component, the possible value starts from 1 to 4. This means that in a task, at least a verb with one action and one UUN component is needed. Other indicators are from 0 to 4. We assume an exponential relationship between the number of elements and the task complexity. Thus, this formula of calculating complexity score of each task component indicator is proposed:

$$Complexity\ score = (e^{x} - 1)/4 \qquad (1)$$

x refers to the number of elements of each indicator, ranging from 0 to 4. The final complexity score of a task is calculated by adding the scores of every task component. To ensure that the scores can be easily interpretated, we aggregate the final score into three classes (Table 2). For now, the thresholds are established arbitrarily according to our experience.

Category	easy task	moderate task	complex task
Range for LoC Score	0.8-2.4	2.5-4.8	>4.8

Table 2. LoC score and task category.

For example, the task "See the depth of water main pipes in this city block" has a complexity score of 2, which will be categorized as "easy task". It can be explained this way: the verb has one semantic meaning with 0.4 score; the component "water mains" contains only one class of pipe with a score 0.4; "depth" is an individual property with 0.4 score, "in this city block" represent the supplementary information with 0.4 score and spatial condition with 0.4 score. No other task component is involved.

Finally, to link LoC and the selection of suitable UUN model, we made a simple assumption that: (after satisfying the minimum UUN model content), if the task is with higher LoC, the better model would be in higher LoD, especially when the complexity value of supplementary and relationship are higher. With lower LoC, the task could be carried out with a UUN model in lower LoD.

5. APPLICATION TO WATER NETWORK MANAGEMENT AND MAINTENANCE

To have better illustration and application, water network management and maintenance is chosen as use case. The whole aim is to provide an adequate and reliable supply of safe water. Maintenance involves activities that keep the system in good operating condition (van Zyl, 2014). Common operation and maintenance tasks contain locating pipes, locating leaks, repairing leaking pipes, flushing, reservoir cleaning, disinfection, checking pump operation, common pump problems, pressure management, etc (van Zyl, 2014). In this application, the involved decision-making processes have been analysed. Considering that the UUN model is helping decision-makers to get a more comprehensive and intuitive perspective, visual tasks are the focus of this paper.

In this application domain, there exists multiple use case according to the needs of the municipality. Granting connection permits to water and sewer networks is one of them. After receiving the request, information of underground infrastructure in a certain place must be obtained to determine whether or not a permit can be granted to the applicant. Containing working steps, information flow and visual tasks have been analysed in previous work (Chen et al., 2021). The common visual tasks can be recorded and decomposed. Therefore, based on the components of a task, a keywords dictionary of this use case could be obtained (Figure 8). This dictionary doesn't list all the possible keywords and combinations.

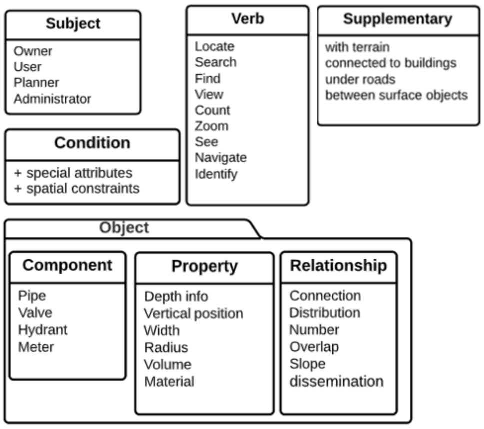


Figure 8. Dictionary of water network management and maintenance visual tasks

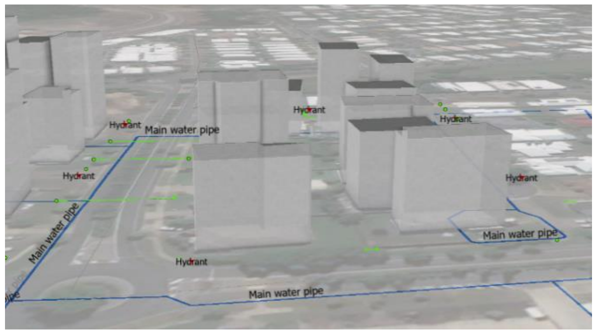
After obtaining the task dictionary, two tasks are selected as examples to illustrate the process of selecting the content of UUN model and get the best LoD. Task 1 = "See the depth distribution of pipes and appreciate the vertical position between surface objects (street and buildings)". Task 2 = "Count the connections of certain pipes".

As explained in the last section, the two tasks are decomposed with a corresponding complexity score. The minimum LoD could be obtained. Based on the definition of MLA LoD, the content of UUN model can be mapped to five variables to describe it (Table 3). The UUN models in higher LoD are also possible solutions.

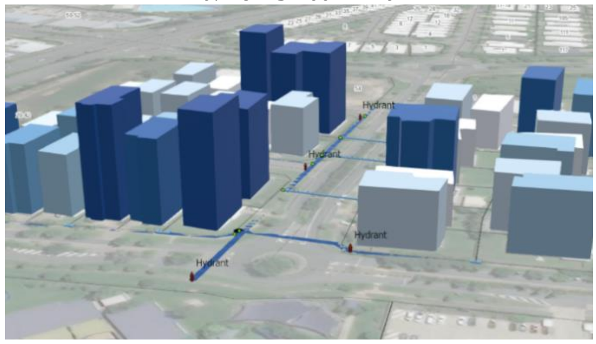
	Task 1 complexity value		**Task 2 & complexity value**	
verb	see	1	count	1
component	pipes	1	pipes	1
property	vertical position	1		
relationship	distribution	0	connections	1
condition	between	1		
supplementary	surface objects	2		
LoC Score	3.2 (moderate)		1.2 (easy)	
minimum LoD and its content	LoD 31-00-11-10 (Figure 9.a)		LoD 21-10-10-00 (Figure 10.b)	
	model in 3D space, 1D geometry, full semantic information, contextual data		model in 2D space, 1D geometry, pipe connectivity information, definition of the pipe component	

Table 3. Task decomposition, LoC score, and possible LoD

For task 1 with a LoC of 3.2, the UUN model that fits better the task's need tends to have a higher-dimensional geometry representation and with multiple cartographic symbols, leading to the LoD 33-00-11-11 (Figure 9.b). Compared to the minimum LoD, it uses 3D geometry to represent pipes, with multiple sets of symbols for representation.



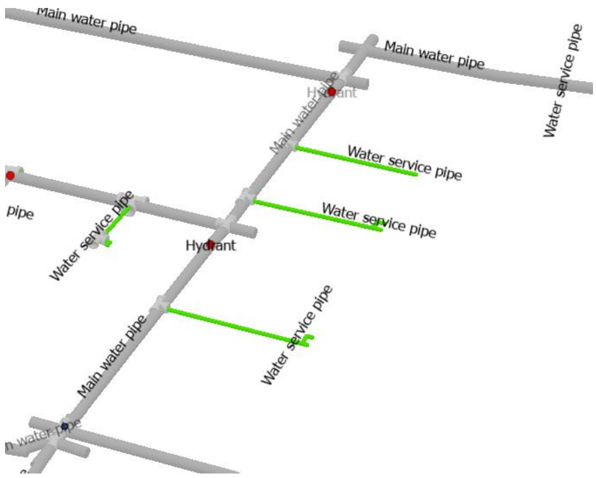
a. LoD 31-00-11-10



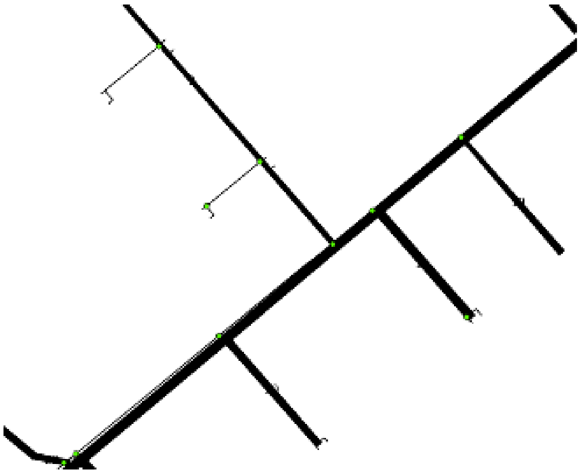
b. LoD 33-00-11-11

Figure 9. Two possible models in different LoD for task "See the depth distribution of pipes and appreciate the vertical position between surface objects (street and buildings)".

For task 2 with a LoC of 1.2, the minimum required LoD is LoD 21-10-10-00. Another possibility is LoD 33-11-10-01. Considering the purpose of this task is to count the number, a higher dimensional geometry representation with multiple symbols would inversely hinder the legibility. Thus, the minimum LoD would be sufficient for this task (Figure 10.b). It selects the content of 1D geometry in 2D space, with pipe connectivity information and identifies the definition of different pipe components.



a. LoD 33-11-10-01



b. LoD 21-10-10-00

Figure 10. Two possible model in different LoDs for task "Count the connections of certain pipes".

6. DISCUSSION AND FUTURE WORK

This paper has proposed a method to systematically decompose decision-making tasks and assign a level of complexity to automatically suggest to the user, the most appropriate level of detail of the UUN model. The level of complexity (LoC) of task is assumed to be the main factor to select the LoD, leading to the most suitable 3D representation with adequate details and showing intuitively visual representation. The complexity and category of tasks are assessed based on the seven indicators of task components. This allows it to become a quantitative description with clear criteria. It reduces the uncertainty and ambiguity of qualitative judgment, making the tasks easy to be evaluated. For now, this division of category of tasks is based on our experience.

As mentioned, we built this research around two main assumptions (suitable LoD is related to LoC and LoC can be deduced from the terms in the query). We are still in the process to validate these two assumptions and we are aware of the limits of these suppositions. We are currently conducting a validation step regarding the possibility to interpret the task complexity based on the terms in the query. To this purpose, a questionnaire will be used. Testers will be asked general feelings about certain tasks, then they will work with 3D UUN model, to see the correctness of their operation result, compared with their judgment. Moreover, the control variable method will be applied when setting the questions, by doing comparison between controlled questions, trying to investigate every indicator is affecting the complexity and has successive levels. By this means, the LoC deduced by task decomposition will be validated.

Currently, we only concentrate on proposing this method of task decomposition and puts forward the possibility of link LoC with LoD and for sure it can present limits. Meanwhile, it is admitted that complexity is not an absolute and fully fixed indicator, there would be relations with people's subjective feelings. Combining users' experiences of 3D with LoC will also be taken into consideration. Besides, this paper gives the assumption that with the lower task complexity, the selection of UUN model content would require fewer complex details; the higher task complexity level would result in higher LoD models. For now, the best selection for content of model (LoD) is based on the analysis of each LoD variable. To validate the consistency of LoD with task requirements will be significant.

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REFERENCES

Albus, J.S., 1993. Task decomposition, in: *IEEE International Symposium on Intelligent Control*. pp. 49–51.

Andrews, C., 2017. The Graphic Complexity Index.

Becker, T., Nagel, C., Kolbe, T.H., 2013. Semantic 3D modeling of multi-utility networks in cities for analysis and 3D visualization. *Lect. Notes Geoinf. Cartogr*. 41–62. doi.org/10.1007/978-3-642-29793-9-3

Biljecki, F., Ledoux, H., Stoter, J., 2016. An improved LOD specification for 3D building models. *Comput. Environ. Urban Syst.* 59, 25–37. doi.org/10.1016/j.compenvurbsys.2016.04.005

Biljecki, F., Ledoux, H., Stoter, J., 2014a. Redefining the Level of Detail for 3D Models. *GIM Int.* 21–23.

Biljecki, F., Ledoux, H., Stoter, J., Zhao, J., 2014b. Formalisation of the level of detail in 3D city modelling. *Comput. Environ. Urban Syst.* 48, 1–15. doi.org/10.1016/j.compenvurbsys.2014.05.004

Biljecki, F., Stoter, J., Ledoux, H., Zlatanova, S., Çöltekin, A., 2015. Applications of 3D city models: State of the art review. *ISPRS Int. J. Geo-Information* 4, 2842–2889. doi.org/10.3390/ijgi4042842

Braarud, P.Ø., Kirwan, B., 2010. Task Complexity: What Challenges the Crew and How Do They Cope, in: Simulator-Based Human Factors Studies Across 25 Years. Springer London, London, pp. 233–251. doi.org/10.1007/978-0-85729-003-8_15

Campbell, D.J., 1988. Task Complexity: A Review and Analysis. *Acad. Manag. Rev.* 13, 40–52. doi.org/10.5465/amr.1988.4306775

Chen, Z., Pouliot, J., Hubert, F., 2021. A first attempt to define Level of Details based on decision-making tasks: application to Underground Utility Network, *ISPRS Archives*. pp. 137–144. doi.org/10.5194/isprs-archives-XLVI-4-W4-2021-137-2021

Gill, T.G., Hicks, R.C., 2006. Task complexity and informing science: A synthesis. *Informing Sci.* 9, 1.

H.Levis, A., Moray, N., Hu, B., 1994. Task Decomposition and Allocation Problems and Discrete Event Systems. Automatica 30, 203–216. doi.org/10.1016/0005-1098(94)90025-6

Ham, D., Park, J., Jung, W., 2012. Model-based identification and use of task complexity factors of human integrated systems. *Reliab. Eng. Syst. Saf.* 100, 33–47. doi.org/10.1016/j.ress.2011.12.019

Jelokhani-Niaraki, M., Malczewski, J., 2015. The decision task complexity and information acquisition strategies in GIS-MCDA. *Int. J. Geogr. Inf. Sci*. 29, 327–344. doi.org/10.1080/13658816.2014.947614

Kolbe, T.H., 2009. Representing and Exchanging 3D City Models with CityGML, in: *3D Geo-Information Sciences*. Springer, Berlin, Heidelberg, pp. 15–31. doi.org/10.1007/978-3-540-87395-2_2

Lieberman, J., Ryan, A., 2017. OGC Underground Infrastructure Concept Study Engineering Report [WWW Document]. URL http://www.opengis.net/doc/PER/uicds

Liu, B., Luo, J., Li, W., 2005. Multi-agent Based Network Management Task Decomposition and Scheduling, in: *19th International Conference on Advanced Information Networking and Applications*. doi.org/10.1109/AINA.2005.254

Liu, P., Li, Z., 2012. Task complexity: A review and conceptualization framework. *Int. J. Ind. Ergon*. 42, 553–568. doi.org/10.1016/j.ergon.2012.09.001

Liu, P., Li, Z., 2011. Toward Understanding the Relationship between Task. *Int. Des. Glob. Dev. Lect. Notes Comput. Sci*. 192–200.

Peachavanish, R., Karimi, H.A., Akinci, B., Boukamp, F., 2006. An ontological engineering approach for integrating CAD and GIS in support of infrastructure management. *Adv. Eng. Informatics* 20, 71–88. doi.org/10.1016/j.aei.2005.06.001

Petrenko, V.I., Tebueva, F.B., Antonov, V.O., Svistunov, N.Y., 2021. Task decomposition and distribution method for heterogeneous multi-robotic systems. {IOP} Conf. Ser. Mater. Sci. Eng. 1069, 12045.

Remington, K., Zolin, R., Turner, R., 2009. A model of project complexity : distinguishing dimensions of complexity from severity, in: *9th International Research Network of Project Management Conference*. Berllin, pp. 25–27.

Robinson, P., 2001. Task complexity, task difficulty, and task production: Exploring interactions in a componential framework. *Appl. Linguist*. 22, 27–57. doi.org/10.1093/applin/22.1.27

Steinitz, C., 2008. On Scale and Complexity and the Need for Spatial Analysis | ArcNews Online [WWW Document]. URL https://www.esri.com/news/arcnews/spring11articles/on-scale-and-complexity-and-the-need-for-spatial-analysis.html

van Zyl, J., 2014. Introduction to Operation and Maintenance of Water Distribution Systems, Water Research Commision.

Welie, M. Van, Veer, G.C. Van Der, Eliëns, A., 1998. An Ontology for Task World Models, in: Design, Specification and Verification of Interactive Systems ’98. Springer, pp. 57–70. doi.org/10.1007/978-3-7091-3693-5_5

Zhang, Y., Jauhar, S.K., Kiseleva, J., White, R.W., Roth, D., 2021. Learning to Decompose and Organize Complex Tasks 2726–2735.