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Procedia CIRP 53 (2016) 63 – 69

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The 10th International Conference on Axiomatic Design, ICAD 2016

Improvement of the compilation process of the Italian income certifications: an application on the tax model of the year 2016 (Part 2)

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Abstract

In this second part, the essay focuses on a real case about the functional decomposition of the application, already dealt in Part 1. The real case described here is about the system design process for the 2016 tax return certification compilation. The input elements of this functional decomposition process are the compilation instructions, the project constraints and the clusters of non-conformity. The proposed method enables to select, on each analysis level, the robust decomposition among the possible substantial decompositions, such as the configuration with the minimum data content. The measure of the system's data content was determined using the technique of function point. The aim is to provide software designers with a robust logical design of the system, in order to respect the fiscal deadlines, satisfying the user's requirements and guarantee a solution of the problems in the operating environment. The proposed application has a strong pro-active value, as it leads to the development of ad hoc solutions, avoiding the implementation of unnecessary data entry that does not provide any benefit neither for the taxpayer, nor to the withholding agent. This approach also allows having the necessary technical documentation at hand, to plan and monitor the implementation of the time of action, thus facilitating the system adaptation in the years to come.

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Peer-review under responsibility of the scientific committee of The 10th International Conference on Axiomatic Design

Keywords: Non-Conformities Reduction; Public Administration; Information content; Function Point.

1. Introduction

In many field the pro-active value of interventions has become increasingly important. Many attempts have been made by the authors in field such as the environmental impact of industrial product [1], the material selection and development [2,3], the road safety [4], and the non-conformities management connected with transactional processes [5-7]. In this framework the software development is a key factor to enable an effective proactive intervention in many transactional processes with special attention on the public sector and its relationship with citizen.

This article describes the functional decomposition method proposed in paper Part 1 for the compilation process of Italian income certifications of year 2016. Basically, the decomposition has been divided into successive levels corresponding to the structure of income certifications under the rules of the composition provided by the Revenue Agency's instructions [7]. We need to underline that the sections building the income certifications are made of more sections. Those sections may be composed of multiple subsections. Each dataset consists of a homogeneous set of information, which has a specific goal in terms of certification and to which we can associate specific computing operations. Thus, areas, sections, and subsections can be positioned as functional requirements of different levels. At all levels, the decomposition cannot be done by remaining in a single domain. The zigzagging process yields a parallel decomposition of two adjacent domains. This decomposition must be carried out until all the information is identified at a level of detail required to start the software development by programmers [8-10]. At each level of decomposition, the designer must ensure the following features:

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Peer-review under responsibility of the scientific committee of The 10th International Conference on Axiomatic Design
doi:10.1016/j.procir.2016.04.205

- compliance with the design constraints;
- adaptation of the system with respect to the cluster of non-conformity catalogued by the tax assistance service[5,6];
- validity of the axiom of independence with respect to the decomposition matrix level. This ensures the consistency of the identified functional requirements;
- validity of the axiom of information as a selection of independent decomposition with lower information content.

This ensures the selection of the minimum functional configuration in terms of function points.

2. The Italian income certification of year 2016

The 2016 standard income tax return form (CUO) certifies the income paid and the taxes withheld for taxpayers who receive a salary as employees, pensions, salaries from self-employment activity and likewise. The CUO is composed of five main sections and various fields, as explained in the list below [7]. The 2016 simplified income and tax return form (CUS), instead, is a summary of the CUO [7]. It contains the earnings and the tax details regarding the taxpayer. It is made available by February 28 in order to inform earners about the amounts declared by the employers to the Revenue Agency. In general, the information contained in the CUO certification can be gathered as follows:

- Front cover. It displays any information on the type of submission, the substitute reference and the details of the submitting representative signatory;
- CT Section. It records any information deemed necessary to receive the application files from the Revenue Agency for tax adjustments from the tax assistance offices (730-4). It displays the refund due to the withholding agents based on the adjustments calculated with the tax return forms received;
- Personal details section. It lists the personal details in order to identify both the taxpayer and the withholding agent;
- Income from dependent employment section. It displays the fiscal and social security data regarding dependent employment certifications and likewise, plus tax assistance;
- Self-employment section. This area displays the fiscal details regarding the fees paid for services provided by taxpayers with a different business collaboration.

3. First level decomposition

The AD methodology is top-down. Thus, we need to start from the highest logical level. In this case, FR = compiling the CUO and CUS income certifications. It follows that: FR=A*DP, where DP is the necessary data for the compilation of income certifications. This data is present under a coded form in the environment of data exchange with the payment procedures. Instead, A refers to extraction methods of data from such interchanging environments and the processing procedures on that data. Furthermore, it must meet the design constraints (C). In this case, the CUO certifications must be submitted to the Revenue Agency by March 7, while the CUS certifications must be made available to taxpayers by February 28. This design constraint is respected by ensuring that the application can retrieve the data directly from the payrolls of the monthly payments. With regard to the cluster of non-conformity (CN) identified by the service, they are not applicable at this level because the level of abstraction is too high.

4. Second level decomposition

We proceed with the decomposition at a lower level. The decomposition is summarized in Table 1. We can define the production of CUO and CUS certifications as second level macro-functional requirements.

Table 1. Level 2 decomposition table

FR	Mapping (A)	DP
CUO production	Compilation	CUO Data
CUS production	Compilation	CUS Data

4.1. Respect of project constraints verification

The design constraint of the CUS 2016 income tax certifications is that the precompiled forms must be made available online by February 28. For the CUO 2016 certification, the deadline is set to March 7. Despite this fact, CUS certifications are a summary of the CUO certifications. This regulatory constraint is respected by compiling the CUO certification first, using the elementary information present in the payment systems as its basis. The interoperability allows the CUO management system to have available the data of payment systems, immediately after each payment is closed. In this case, different systems share objects / data (components) [11]. CUO data feedings are due every month. At the end of the year, the data process and upload for tax calculation must be started, according to the Revenue Agency's instructions.

4.2. Preventive system adjustment on the basis of non-conformity clusters

Some non-mandatory social benefits (supplementary pensions, university years’ fees buybacks, re-joining of different contribution periods) are delivered to citizens through the payment of a financial contribution from the beneficiaries. These sums can be deducted directly from salary and are withheld for the tax deduction for the citizen. These amounts are reported in the income certification. In addition, these payments must be paid to social security institutions, that are obliged to declare the amounts electronically to the Revenue Agency by February 28 [12, 13]. For social security institutions, clusters of non-conformity may occur due to the mismatch between what is declared in the income certification (such as social security charges, insurance and deductible expenses) and anything communicated to the Revenue Agency, along with the mandatory communications about these expenses (CPR). In this case, this cluster of non-conformity can be solved proactively by integrating the process of preparation of benefits (together with other communications such as insurance taxes, passive or active interests, mortgage taxes for the purchase of an estate as a main residence and deductible expenses) in the compilation system of the income revenue forms. This issue implies the introduction of a new functional requirement that corresponds to the preparation of the declaration of deductible costs and expenses. Table 2. illustrates the new correlation matrix.

4.3. Axiom of information

At this level of detail, the data needed to set a measure in terms of Function Points is insufficient. However, a valuation can be set in terms of Early and Quick Function Point [14]. Nevertheless, in our case, it is not necessary to measure the content of the decomposition information, because this configuration does not have other alternative solutions that can respect the independence axiom. Comparisons are not necessary.

Table 2. Level 2 matrix decomposition, including the production of social security charges reports.

	Data compilation CUO (DP1)	Data compilation CUS (DP2)	**Tax credits, social benefits and insurance taxes Data compilation (DP3)**
CUO production (FR1)	X		
CUO production (FR2)	X	X	
Production and submission of Tax credit reports, social benefits and insurance taxes (CPR) (FR3)	**X**		**X**

5. Third level decomposition

As the DPs at the second level are not detailed enough to provide with the desired specifications, these FRs must be decomposed. The decomposition follows a zigzagging process. For the design defined by the selected set of DPs, FR1, FR2 and FR3 may be decomposed as shown in Table 3, column FR. This functional decomposition corresponds to the sections required by the tax declaration forms CUO, CUS and CPR [7, 12, 13]. This means that at this level, for example, the section about any income from employed work will correspond to the FR13 macro functional requirement as illustrated in Table 3. This correspondence allows measuring the function point content of macro functional requirements of this level in a simple way. In fact, the Revenue instructions provide all the necessary information to measure using Function Points accurately [7]. At this stage, we can list the different sections of CUO, CUS and CPR declarations, which represent the functional requirements of this level (FR). The data structures necessary to draw the information for the compilation of each section are the design parameters (DP). On the other hand, the actions to be called on the data structures to fill in the CUO declaration sections are the methods. In this phase, the level of detail is still very general. Table 3. summarizes this process. The correlation matrix is created by using the information in the above table, as shown in Fig. 1. It represents the complete third-level decomposition, where each macro functional requirement corresponding to the certification sections has been measured in function points.

5.1. Verification of compliance with the project constraints

At this level, the synthetic income tax CUS certification is a summary of the CUO certification, and this is considered as a constraint for the design of the project. Therefore, the CUS subsystem is only limited to the visualization and the exposure of the data already processed in CUO subsystem. This means that the heart of the process is the CUO subsystem. In terms of function points, the CUS subsystem has a lower effort since the functional requirements are fulfilled by data display of transactional functions (External Output) and the external data structures (External Interface File) [14]. In other words, the data processing functions are carried out by the CUO subsystem, which has a larger data content.

Table 3. Third level decomposition

FR	Ai (methods)	DP
FR11:Electronic Submission CUO	Compilation	DP11:Submission Data
FR12:Personal Data CUO	Compilation	DP12:Personal Details CUO
FR13:Work as employed CUO	Compilation	DP13:Work as employed data CUO
FR14:Work as self-employed CUO	Compilation	DP14:Work as self-employed data CUO
FR21:Personal Data CUS (FR21)	Compilation	DP21:Personal details CUS
FR22:Work as employed CUS	Compilation	D22:Work as employed data CUS
FR23:Work as self-employed CUS	Compilation	DP23:Self-employed data CUS
FR31:Tax credit reporting	Compilation	DP31:Tax credit report data

	DP11	DP12	DP13	DP14	DP21	DP22	DP23	DP31	Function Point
FR11	X								62
FR12		X							54
FR13		X	X						603
FR14		X		X					90
FR21		X			X				20
FR22		X	X			X			202
FR23		X		X			X		29
FR31		X	X					X	137
									1197

Fig. 1 AD matrix with third level decomposition

5.2. Preventive system adjustment on the basis of non-conformity clusters

At this level, interventions to adapt the system to take into account the non-conformity clusters are not present.

5.3. Axiom of independence

The selected functional decomposition is consistent. The relations between functional requirements and design parameters are about a decoupled type. Therefore, the axiom of independence appears to be satisfied.

5.4. Axiom of information

The Revenue Agency's instructions allow performing, at this level of decomposition, an accurate measurement in terms of function points. The measurement was made with respect to functional requirements (FR) using the IFPUG 4.1 counting method [15]. This counting technique is based on the identification of data files and the transactional functions that are referenced by functional requirements. Two types of data files are present: ILF (Internal Logical Files) and EIF (External Interface Files). There are three types of transaction functions: EI (External Input), EO (External Output) and EQ (External Inquiry). The level of decomposition is, of course, still low in details and this does not allow us to identify any alternative decompositions.

5.5. Function point counting example

Fig.2 illustrates the counting operations in function points for the macro functional requirement "CUO (FR11) Electronic submission"

Section	Type	Description	RET/FTR	DET	Complexity	FP
FR111	ILF	Front cover data	4	19	H	15
	EI	Withholding agent data insert	1	2	L	3
	EI	Withholding agent data delete	1	17	A	4
	EI	Communication type delete	1	17	A	4
	EQ	Front cover View	1	2	L	3
	EI	Communication type insert	1	19	L	3
FR112	ILF	CT section data	3	10	H	15
	EI	Withholding agent data insert	1	4	L	3
	EI	Entratel data insert	1	4	L	3
	EI	Withholding agent data delete	1	8	L	3
	EI	Entratel data delete	1	4	L	3
	EQ	CT section View	1	10	A	3
						62

Fig. 2. FP estimate of "CUO (FR11) Electronic submission"

As Fig. 2 shows, the F11 section consists of two subsections. The Title Page (FR111) compiling section, and the CT (FR112) section, which defines the type of declaration to be submitted electronically to the Revenue Agency. The count is based on the identification of the elementary data files (ILF / EIF) and of the elementary transactional functions (EI / EO / EQ) that allow the compilation of the CUO 2016 sections due for delivery to the Revenue Agency. Basically, we will now limit our dissertation to the (FR111) Title Page compilation: the CUO 2016 instructions specify that this section is composed of a mask with four homogeneous data subsets (RET = 4). Provided eligible functions can “add” and “modify” data of the withholding agent and of the system information. Furthermore, a visible data entry function is provided. In terms of data functions, this means that we have a unique ILF corresponding to the data entry form, which is divided into four homogeneous data groups (RET = 4). In the form, 19 fields are maintained by the system. In terms of transactional functions, we have four EIs. Two EI functions correspond to the functions of insertion and modification of personal details of the withholding agent. 17 fields in the form are retained by these two EIs. These 17 fields refer to the four subsets of homogeneous data. Therefore, the two EIs are said to have four FTR. The two other EIs, however, correspond to insertion and editing functions of the type of communication to be inserted. Each of these functions only keeps two fields (DET), related to one single subset of the frontispiece mask (FTR = 1). In addition, user specifications have a display function of all the data on the title page (DET = 19, FTR = 4). The evaluation of DET and RET / FTR associated to the different functions allow determining their complexity, and therefore their value in function points, as shown in the figure.

6. Fourth level decomposition

We will now proceed with a further functional decomposition. The CUO and CUS certifications and tax reports are divided into sections that were represented on the third level of functional decomposition. Every single section is divided into several sub-sections representing a set of specific data that corresponds to a specific function in the system. In an attempt to simplification, we will report only the decomposition regarding the Employee Work (FR13) section of the 2016 CUO certification. Table 4 represents the elements of this decomposition. They were placed, in the first instance, in the corresponding Employee Work field sections (FR13).

At this stage, we can build the correlation matrix between functional requirements (FR) and design parameters (DP) as shown in Fig. 3. The resulting matrix highlights the fact that the functional requirements of the section regarding the income as an employee CUO are interdependent. Therefore, the functional relations of the “Work as a dependent employed” matrix are of the coupled type. The axiom of independence is not valid. It is necessary to redefine the functional requirements of the “Work as a dependent employed” matrix of the CUO certification.

Table 4. Fourth level decomposition

FR	DP
FR13.1: to insert income data	DP13.1: income data from payment systems
FR13.2: to compile withholding tax section	DP13.2: withholding tax data from payment systems
FR13.3: to insert 2015 tax assistance data	DP13.3: 2015 tax assistance data from payment systems
FR13.4: to insert suspended tax assistance data	DP13.4: suspended Tax assistance data from payment systems
FR13.5: to insert marital tax assistance data	DP13.5: marital tax assistance data from payment systems
FR13.6: to insert deductible expenses	DP13.6: deductible expenses data from payment systems
FR13.7: to compile tax deductions and credits section	DP13.7: tax deductions and credits data from payment systems
FR13.8: to insert supplementary social security funds data	DP13.8: supplementary social security funds data from payment systems
FR13.9: to compile reductions section	DP13.9: reductions data from payment systems
FR13.10: to compile section Other Data	DP13.10: Other Data from payment systems
FR13.11: to insert income subject to withholding as a tax	DP13.11: income subject to withholding as a tax from payment systems
FR13.12: to insert fees relating to prior years	DP13.12: fees relating to prior years from payment systems
FR13.13: to compile section of the related adjustments to data	DP13.13: adjustments data from payment systems
FR13.14: to insert dependent family members data	DP13.14: dependent family members data from payment systems
FR13.15: to insert social security data	DP13.15: social security data from payment systems
FR13.16: to insert employee severance indemnity- TFR data	DP13.16: TFR data from payment systems

	DP13.1	DP13.2	DP13.3	DP13.4	DP13.5	DP13.6	DP13.7	DP13.8	DP13.9	DP13.10	DP13.11	DP13.12	DP13.13	DP13.14	DP13.15	DP13.16	FP
FR13.1	X	X						X	X	X			X				38
FR13.2	X	X				X	X	X	X	X			X	X			41
FR13.3			X														36
FR13.4				X													26
FR13.5					X												38
FR13.6		X				X	X			X			X				25
FR13.7	X	X				X	X			X			X				47
FR13.8								X	X		X					X	50
FR13.9		X						X	X								37
FR13.10	X	X				X	X	X	X	X			X	X	X		51
FR13.11											X						28
FR13.12							X					X					25
FR13.13	X	X				X	X	X	X	X			X	X	X		45
FR13.14	X	X				X	X			X			X	X			25
FR13.15															X		45
FR13.16																X	46
																	603

Fig. 3.Fourth level of non-optimized decomposition

6.1. *Axiom of independence*

The CUO "Income from dependent employment" matrix can be made consistent by aggregating some functional requirements since these sections refer to the same activity. In fact, the sections that are affected by tax adjustment can be matched. This aggregation at a design level corresponds to representing the affected sections of the tax adjustment by the same module (class). Fig. 4 shows the aggregation mode. This intervention makes the whole matrix consistent.

		DP13.1NEW	DP13.3	DP13.4	DP13.5	DP13.6	DP13.14	DP13.8	DP13.9	DP13.11	DP13.12	DP13.14	DP13.15	FP
FR13.1														
FR13.2	Fiscal Adjustment ($FR_{13.1NEW}$)													
FR13.10		X												
FR13.13														
FR13.7														222
FR13.3			X											36
FR13.4				X										26
FR13.5					X									38
FR13.6		X				X								25
FR13.14		X					X							25
FR13.8		X						X						50
FR13.9		X							X					37
FR13.11										X				28
FR13.12											X			25
FR13.15												X		45
FR13.16													X	46
														603

Fig. 4. Fourth level decomposition verifying the axiom of independence

6.2. *Axiom of information*

This level of decomposition allows applying some further aggregations of similar functional requirements, as shown in Fig. 6. These aggregations allow the general matrix to remain consistent but can reduce the total number of function points. These operations consist in having similar functions run by one module (class). In this case, the polymorphism of the object-oriented languages supports the extension to any similar actions of a class [16]. As an example, we can run, from a single class of objects, any compiling activity in the sections relating to tax assistance (FR13.3, FR13.4, FR13.5). The same type of aggregation can be applied between "supplementary social security funds" (FR13.3)" and "deductible expenses (FR13.3)", as well as among "Dependent family members (FR13.3)" and "Deductible tax credits (FR13.3)". Therefore, three new combinations of functional requirements are introduced, which can actually be performed by a single module. Fig. 5 shows the functional combinations applied. The three groupings introduced (Tax Assistance, deductions and tax credits) reduce the amount of system data, although the functional requirements of the matrix remain of a decoupled type. Therefore, we can assume that the application of the information axiom enables both to select the functional decomposition (with minimal information content value) and to optimize the system development. This optimization occurs both in terms of fewer resources necessary for the development and in terms of an improved system performance, for the comfort of the end user. In fact, similar functions are gathered in the same areas of the program, enhancing the learning process and the use by operators [17]. In addition, this approach (involving the decomposition of the functional requirements and the regrouping of some of their subgroups) matches also with the implementation aspects, in terms of property inheritance and polymorphism of object-oriented languages [18, 19]. At the same time, this approach allows to provide with an objective planning tool in software design [20].

		DP13.1NEW	DP13.2NEW	DP13.6NEW	DP13.8NEW	DP13.11	DP13.12	DP13.14	DP13.15	FP
FR13.1	Fiscal Adjustment ($FR_{13.1NEW}$)	X								222
FR13.2										
FR13.10										
FR13.13										
FR13.7										
FR13.3	Tax Assistance (F13.2NEW)		X							56
FR13.4										
FR13.5										
FR13.6	Tax deductions (FR13.6NEW)	X		X						44
FR13.14										
FR13.8	Reductions (FR13.8NEW)	X			X					77
FR13.9										
FR13.11						X				28
FR13.12							X			25
FR13.15								X		45
FR13.16									X	46
										575

Fig. 5. Robust decomposition.

6.3. Verification of compliance with project constraints

At this level there are no design constraints

6.4. Preventive system adjustment based on non-conformity clusters

At this level, system interventions in order to take into account the non-conformity clusters are not present. At a more detailed level, the non-conformity clusters that were previously catalogued will result in the introduction of additional features to the system required by the Inland Revenue's instructions. These additional features are dependent on the specific operating environment.

7. Conclusions

The methodology of functional decomposition that we propose has allowed us to select the robust decomposition for each logic level of the production process of the 2016 Income Certifications. Moving further into the functional decomposition, a greater level of detail introduces us to the conceptual design of the system to be provided to programmers for the later stages of development. This conceptual design corresponds to the most rational functional configuration for system purposes, having the minimum information content in terms of function points. This result is equivalent to designing a system that can meet the user's requirements, while lowering the development costs. It also enhances the usability of the system because a design solution is selected using a minimum number of redundant features. In addition, the focus in the process of functional decomposition to design constraints and non-conformity clusters triggers the development of customized solutions for a specific operating environment. In this case study, we turned our attention to the proper compilation of pension and insurance benefits of the income declaration. This particular need has resulted in the integration of the process of preparation of the electronic communications relating to social security contributions with compilation system of income certifications. This design approach is particularly useful also for the subsequent operating managing phases of the system, since it allows having a continuously updated technical documentation available. In fact, the development maintenance interventions due in the years to come are easy to implement because the actions to be taken to implement the system can be detected by retracing the functional decomposition process, following the compilation instructions. In fact, the modularity of the decomposition structure allows the reuse of the software that had already been implemented for the 2016 version of the system. Furthermore, the function point measure of the functional decompositions allows to plan maintenance operations in detail, especially in terms of resources, time and costs. This is a remarkable achievement, considering the strict fiscal deadlines and the huge number of changes in the tax laws.

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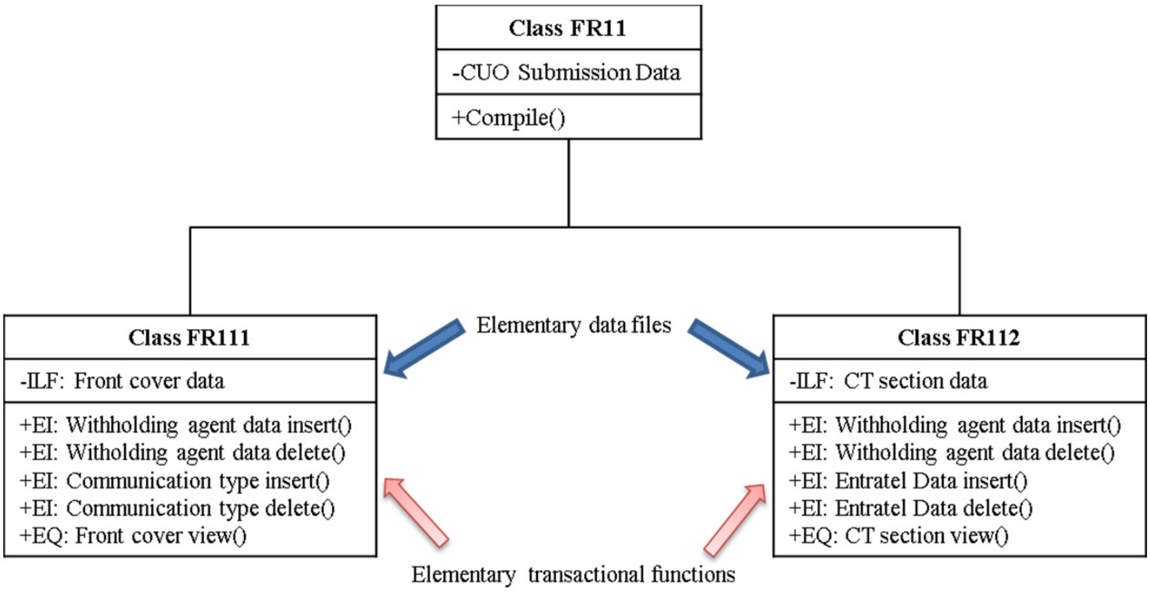

Fig. 6. UML diagram for M11 module related to "CUO Electronic submission (FR11)"