Technical Report: Navigation analysis vs. navigation design

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Abstract This technical report supplements the paper entitled 'Conceptual Navigation Analysis: a device and platform independent navigation specification'. It represents a first attempt to provide a (non-exhaustive) list of aspects that we consider should belong to an analysis navigation model. Also, we include an initial set of features that we think should be postponed until the navigation design phase of any hypermedia conceptual modeling proposal. We consider such lists constitute the first step for a sound definition of both an analysis and a design navigation model. Also, and in order to clarify the concepts presented, this report includes a sample application around which the discussion is developed: a ticket reservation system.

1 Introduction

Most existing Web applications conceptual modeling approaches are based on design concepts, such as pages and access primitives, on which the navigational specification of the system is usually built. However, the increasing complexity of these applications that are becoming more flexible, personalized and mobile are causing such applications and their related models to become increasingly complex and less reusable. We stress in our article "Conceptual Navigation Analysis: a device and platform independent navigation specification" ([1]) that this problem can be lessened by integrating a navigation analysis model exclusively based on the user requirements. Supporting this idea, we introduced there the concept of *semantic navigation* defined as **a voluntary change of user aim, what justifies the necessity of a user interaction to determine that such semantic navigation exists.** In other words, the user performs a voluntary invocation of what we call a *Navigation Semantic Unit* (NSU) following a *Navigation Semantic Link* (NSL). These concepts allow us to define a navigation analysis model and distinguish it from the navigation design models known so far.

In this report we supplement that paper ([1]) with an analysis of actions classified as relevant for navigation analysis or for navigation design (Section 2 and 3). In addition, in Section 4 we present an example to illustrate some of the aspects discussed in our paper ([1]).

2 Navigation Analysis Concerns

A partial summary of **actions that we consider may be relevant from a semantic navigation point of view** (although they will not always be) includes:

- Back button in a browser
- History lists
- Operation calls

We consider all these navigation structures and/or actions may be caused by a change in the user aim while navigating through the system, and so they should be treated with special care. As an example, the *back button* may be used as a shortcut to avoid going back and forth through a menu tree. Although the use of this kind of mechanism is not always recommended (and in fact some interfaces even hide such navigator possibility), if provided it may arise some interesting questions. For example, should the *back* action cause the system to show a previous view structure but with the actual system contents, or should it additionally cause the system to go back to that previous state? On the other hand, if going *back* implies going to the previous page during an input parameter process, obviously this action does not have any semantic consequence, and its use is less likely to cause any problem or misunderstanding. The history list suffers more or less from the same problems. Our aim in this report is not to provide a whole discussion about this and other topics, but to stress the fact that back buttons and history lists are shortcuts that may correspond or not to semantic links, and that even inside the same category (semantic link/design link), they may have different semantics associated depending on the application. Users should be aware in advance of which behaviour to expect from any navigation construct, but this fact becomes specially relevant when we are implicitly associating a user 'semantic intention' to the activation of such constructs, which is quite usual when dealing with back buttons and/or history lists.

The remaining item, the operation call, is perhaps the most controversial. Why an operation call may imply navigation? We would like to make clear that the reason is not the execution of any underlying method, no matter it is remote or not (in fact we are not even concerned with such details at this level of abstraction), but the change of user aim that the invocation of such operation (that might also have associated the visualization of the operation response) might imply. In fact, going a step further, we might have a single 'interface service' (what some authors call an Internet Transaction) that may stand on a set of independent operations, that is, may imply a set of operation calls to be fired at once. In this case, and from a user perspective, there would still exists a single navigation action.

3 Navigation design concerns

Continuing with our reflection, and based on the previously stated conditions that the semantic navigation should fulfill, we consider the following list includes some examples of **design navigation structures that do not imply semantic navigation**:

- Index hierarchies (except for their leafs)
- Guided tours applied to object sets
- Pagination of object sets
- Scrolling links
- Refresh button in a browser, even if it causes the information on screen to be updated
- Links not explicitly activated by the user of the application
- Multistep parameter input interfaces

From these examples, we think the last two are the most prone to cause controversy. 'Automatic' links, on one hand, are not considered to cause semantic navigation for two main reasons: first of all the user is not implied in the process (so we cannot assure there effectively was a change in the user intention). On the other hand, those links are much more unstable than 'manually activated' ones, and could make the model dependent on final implementation decisions. For example, they could eventually give birth to any kind of video or any other multimedia construct, thus disappearing from the model[1].

With multistep parameter input interfaces we refer to a set of pages, each including a subset of the parameter values needed to finally invoke an operation. We regard this parameter splitting process as a kind of 'parameter pagination'. The reason why we do not consider that it implies any kind of semantic navigation is that the underlying aim while passing from one page to the other is still to invoke the same operation.

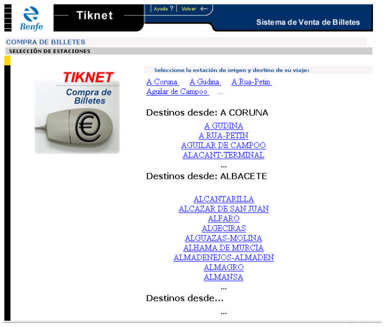
4 Discussion trails

To further illustrate some of the aspects presented so far and arise discussion, let's give another example. Let's suppose we want to model a *Train Reservation*

[1] It is evident that, if we get out from the application conceptual modeling and enter other fields such as authoring processes for the edition of e.g. such video, the work granularity level varies, and other criteria would be applicable.

System such as the one that can be found at $http://www.renfe.es$. Let's also suppose the requirements for this system include the following one: *for a given route, show the trains that cover it and also have seats available for this route.* As interface designers, we could think about several ways to interact with the user and finally present the information required. Four examples of such possibilities are:

1. A single page with a list of origins and, for each origin, a nested list of destinations, alphabetically ordered (see Fig. 1). Activating any destination link, the user would obtain the view of the set of trains that cover the desired route and have available seats, as can be seen in Fig. 2.



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de origen y destino de su viaje:

A Coruna   A Gudina   A Rua-Petin
Aguilar de Campoo   ...

Destinos desde: A CORUNA

A GUDINA
A RUA-PETIN
AGUILAR DE CAMPOO
ALACANT-TERMINAL
...

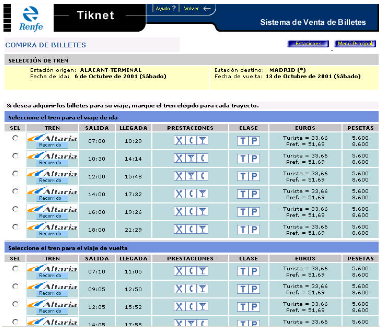
Destinos desde: ALBACETE

ALCANTARILLA
ALCAZAR DE SAN JUAN
ALFARO
ALGECIRAS
ALGUAZAS-MOLINA
ALHAMA DE MURCIA
ALMADENEJOS-ALMADEN
ALMAGRO
ALMANSA
...

Destinos desde...

...

Figure 1. Simple Listing



COMPRA DE BILLETES

SELECCIÓN DE TREN

Estación origen: **ALACANT-TERMINAL**
Fecha de ida: **6 de Octubre de 2001 (Sábado)**

Estación destino: **MADRID (*)**
Fecha de vuelta: **13 de Octubre de 2001 (Sábado)**

Si desea adquirir los billetes para su viaje, marque el tren elegido para cada trayecto.

Seleccione el tren para el viaje de ida

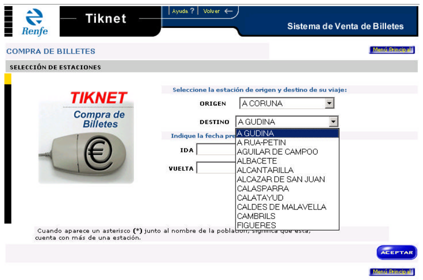
SEL	TREN	SALIDA	LLEGADA	PRESTACIONES	CLASE	EUROS	PESETAS
○	Altaria Recorrido	07:00	10:29	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	10:30	14:14	X 🍸 ☾	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	12:00	15:48	X 🍸 ☾	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	14:00	17:32	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	16:00	19:26	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	18:00	21:29	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600

Seleccione el tren para el viaje de vuelta

SEL	TREN	SALIDA	LLEGADA	PRESTACIONES	CLASE	EUROS	PESETAS
○	Altaria Recorrido	07:10	11:05	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	09:05	12:50	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria Recorrido	12:05	15:52	X ☾ 🍸	T P	Turista = 33,66 Pref. = 51,69	5.600 8.600
○	Altaria	14:05	17:55	X 🍸 ☾	T P	Turista = 33,66	5.600

Figure 2. Desired result view

2. In two implicit steps (without changing the 'physical page', see Figs. 3 and 4) by means of a *javascript* function that encapsulates part of the application logic. When the user chooses an origin, an event *onChange* is activated, which calls a function that loads the destinations available for this origin in a *combo box* provided for such matter, in a dynamic way. Then, the user chooses a destination and the system offers her the trains with available seats (see Fig. 2).
3. In two explicit steps (changing the physical page, see Figs. 5 and 6): the user chooses the origin, clicks on *accept*, receives a list of destinations, chooses the one s/he desires, and this last selection drives her to the same results page presented above (see Fig. 2).
4. As a result of an underlying operation whose signature is *public getAvailability(in origin:City, in dest:City, in depDate:Date, in arrDate:Date, out trainsAvailable:TrainSet)* (see Fig. 7) The visualization of the set of trains provided by the underlying method execution is again that presented in Fig. 2.



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de origen y destino de su viaje:

ORIGEN A CORUNA

DESTINO A GUDINA

A GUDINA
A RUA-PETIN
AGUILAR DE CAMPOO
ALBACETE
ALCANTARILLA
ALCAZAR DE SAN JUAN
CALASPARRA
CALATAYUD
CALDES DE MALAVELLA
CAMBRILS
FIGUERES

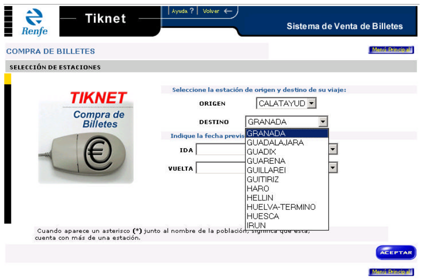
Indique la fecha pre

IDA

VUELTA

Cuando aparece un asterisco (*) junto al nombre de la población, significa que ésta, cuenta con más de una estación.

Figure 3. Automatic destination load when selecting the origin



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de origen y destino de su viaje:

ORIGEN CALATAYUD

DESTINO GRANADA

GRANADA
GUADALAJARA
GUADIX
GUARENA
GUILLAREI
GUITIRIZ
HARO
HELLIN
HUELVA-TERMINO
HUESCA
IRUN

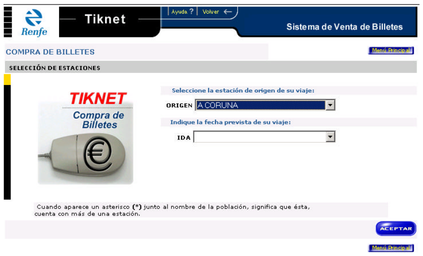
Indique la fecha previs

IDA

VUELTA

Cuando aparece un asterisco (*) junto al nombre de la población, significa que ésta, cuenta con más de una estación.

Figure 4. Dynamic destination change when changing the origin



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de origen de su viaje:

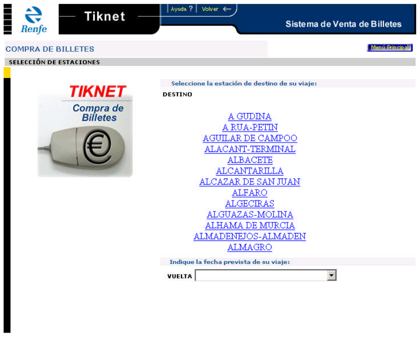
ORIGEN A CORUNA

Indique la fecha prevista de su viaje:

IDA

Cuando aparece un asterisco (*) junto al nombre de la población, significa que ésta, cuenta con más de una estación.

Figure 5. Page with origins



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de destino de su viaje:

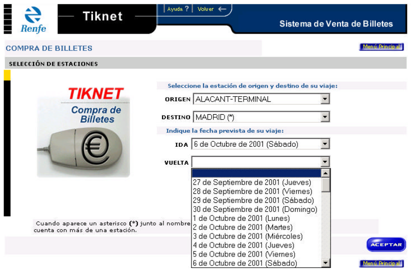
DESTINO

A GUDINA
A RUA-PETIN
AGUILAR DE CAMPOO
ALACANT-TERMINAL
ALBACETE
ALCANTARILLA
ALCAZAR DE SAN JUAN
ALFARO
ALGECIRAS
ALGUAZAS-MOLINA
ALHAMA DE MURCIA
ALMADENEJOS-ALMADEN
ALMAGRO

Indique la fecha prevista de su viaje:

VUELTA

Figure 6. Page with destinations



COMPRA DE BILLETES

SELECCIÓN DE ESTACIONES

Seleccione la estación de origen y destino de su viaje:

ORIGEN ALACANT-TERMINAL

DESTINO MADRID (*)

Indique la fecha prevista de su viaje:

IDA 6 de Octubre de 2001 (Sábado)

VUELTA

27 de Septiembre de 2001 (Jueves)
28 de Septiembre de 2001 (Viernes)
29 de Septiembre de 2001 (Sábado)
30 de Septiembre de 2001 (Domingo)
1 de Octubre de 2001 (Lunes)
2 de Octubre de 2001 (Martes)
3 de Octubre de 2001 (Miércoles)
4 de Octubre de 2001 (Jueves)
5 de Octubre de 2001 (Viernes)
6 de Octubre de 2001 (Sábado)

Cuando aparece un asterisco (*) junto al nombre

cuenta con más de una estación.

Figure 7. Parameter introduction page for the *getAvailability()* operation

4.1 Conclusions derived from the example

All these implementation possibilities usually imply variations in the design navigation models. As we claim they should not, however, influence the analysis navigation model, characteristics that vary from one possibility to another will be factors that should not be considered in the semantic navigation definition, namely:

- Options 1 and 2 do not require any connection to a remote server, while options 3 and 4 do. This fact ratifies our assumption that server connections are not enough nor necessary to determine the existence of semantic navigation.
- Options 1, 2 and 4 present all the information in the same page (with or without the help of a *javascript* function). On the contrary, option 3 shows the information related to the journey destination in a different 'page'. Therefore, neither the fact that the visualization takes place in the same 'physical page' or in different pages should be a sufficient criterion to determine the existence of semantic navigation.
- In options 2 and 3, the destination cities presented depend on a previous user interaction selecting the origin city. On the contrary, in options 1 and 4 the user selects origin and destination in a single step. It can therefore be deduced that a user interaction is a necessary but not sufficient condition to consider that there exists semantic navigation.
- Last, in Option 4 the underlying domain structure provides an operation that fulfills the requirements, what shows that operation invocation (1) may substitute the definition of navigation paths (what in turn justifies its inclusion as part of the navigation design model) and (2) may (although does not necessarily) imply a semantic navigation step.

References

[1] C. Cachero, N. Koch, J. Gómez, and O. Pastor. Conceptual Navigation Analysis: a device and platform independent navigation specification. In *Sent to the Second International Workshop on Web-Oriented Software Technology IWWOST'02*. ECOOP Workshop Proceedings, 06 2002.