Open Personalization: Involving Third Parties in Improving the User Experience of Websites

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Supervised by Prof. Dr. Oscar Díaz and Dr. Jon Iturrioz
San Sebastián – March 15th, 2013
Two premises sustain this work
Premise 1

- Web content growth
- Web user diversity growth

= Stringent Web personalization demands
Web content growth

Total number of websites (linear scale)

Netcraft, February 2013
Web user diversity growth

Internet population 2007 vs 2012, a 2x increase in 5 years

- North America: 233M → 273M
- Europe: 322M → 501M
- Asia: 418M → 1B
- Latin America: 110M → 236M
- Africa: 34M → 140M
- The Middle East: 20M → 77M
- Oceania: 19M → 24M
- World: 1.15B → 2.27B

Data source: Internet World Stats

www.pingdom.com
I need ...

I would love ...

Please, add ...

Stringent Web personalization demands
Premise 2

Stringent Web personalization demands + Limited IT resources = Not all user requirements can be foreseen / afforded
Limited IT resources

Alinean ValueBase™ IT Spending Metrics, 2010
Cost of Development

Importance

IT personnel focus

Number of Potential Users

Not all user requirements can be foreseen / afforded
OPEN PERSONALIZATION:

Empowering users with Web personalization means
What type of users?

- Partners
- Fans
- Laymen

Cost of Development

+ Importance

11 / 89
Target Audience: Partners

How can website owners open their site to their partners allowing the modification of the user interface?
Target Audience: Fans

How can website support, promote and coexist with user provided modifications?
How can we empower laymen to customize their Web Experience by **modifying** the Web by themselves?
A **Mod** is an artefact that **modifies** a Website

A **Mod** is created by any user different from the Website owner
The Domain Model

- **Domain Model**
- **Store**
- **Book**
- **Author**
- **Navigation Model**
- **Presentation Model**
- **User Model**
- **Adaptation Model**
The Navigation Model
The Presentation Model

Presentation Model

Size

Margin
The User Model

Books viewed by the user

Your Recent History

Recently Viewed Items

- What Is HTML5?
  Brett McLaughlin
  Kindle Edition

- Professional JavaScript for Web...
  Nicholas C. Zakas
  Paperback
The Adaptation Model

Recommended books for the user
Deconstructing a Website

Website

Domain Model

Navigation Model

Presentation Model

User Model

Adaptation Model
1. Partners’ personalization
2. Fans’ personalization
3. Laymen’s personalization
Partners’ personalization

Diagram showing the relationship between the degree of novelty and the openness of cooperation, with categories ranging from truly differentiating to commodity, and from closed to open.
Collaborative Software Development

Collaborative development gets more interesting when there are dependencies between companies’ activities.

Company A

Special discounts

Provided

Facilitates

Advertising

Company B

Exclusive promotions

Sharing revenue
A case study: ICWE Website

- Host provides conference information
- Accommodation partners provide accommodation booking information
A case study: ICWE Website

Attendee registration is full

50% discount in accommodation

Barceló HOTELS & RESORTS

icwe'09

Attendee registered seminar

10% discount in books of seminar’s author

Springer
How can the host safely open up the web to his partners?
Modding Interface

It allows partners to access Website’s resources in a controlled way.

It shields partner’s contribution from Website’s design decisions that might eventually change.
Modding Interface as annotations

Code annotation is a form of syntactic metadata that can be added to source code

```java
@MyAnnotation ("Parameter1")
public void mymethod() {
    ....
}
```
Accommodation
Web fare

Web fare on 28th of April, 2009. IMPORTANT: Prices can change.

<table>
<thead>
<tr>
<th>Hotel / Web fare</th>
<th>Single</th>
<th>Double</th>
<th>Estimated distance (Km / Min on foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barceló Costa Vasca 4*</td>
<td>From 121 €</td>
<td>From 121 €</td>
<td>0.5 Km / 7 min</td>
</tr>
<tr>
<td>RECOMMENDED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="http://www.barcelocostavasca.com">www.barcelocostavasca.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH Aranzazu 4*</td>
<td>From 108.23 €</td>
<td>From 106.23 €</td>
<td>0.8 Km / 10 min</td>
</tr>
<tr>
<td><a href="http://www.nh-hotels.com">www.nh-hotels.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Sebastian 4*</td>
<td>From 115.56 €</td>
<td>From 144.45 €</td>
<td>0.6 Km / 8 min</td>
</tr>
<tr>
<td><a href="http://www.hotelsansebastian.net">www.hotelsansebastian.net</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tryp Orly 4*</td>
<td>From 107 €</td>
<td>From 107 €</td>
<td>1 Km / 12 min</td>
</tr>
<tr>
<td><a href="http://www.soimelia.com">www.soimelia.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Londres 4*</td>
<td>From 98 €</td>
<td>From 130 €</td>
<td>1.2 Km / 14 min</td>
</tr>
<tr>
<td><a href="http://www.londres.com">www.londres.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hesperia Donostia 4*</td>
<td>From 96 €</td>
<td>From 123 €</td>
<td>2.3 Km / 28 min</td>
</tr>
<tr>
<td><a href="http://www.hesperia.com">www.hesperia.com</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niza 3*</td>
<td>From</td>
<td>From</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Proceedings

LNCS conference proceedings are available online.
LNCS 5648 at Springer
LNCS 5648 at SpringerLink

Organizers

Sponsors

nekin
The host without Modding Interface
The host with Modding Interface
Host annotates PROVIDED domain & user related classes

```csharp
using System.Collections.Generic;

[ModdingConcept(PublishingEventType.Load)]
[ModdingConcept(ProcessingEventType.AddViewMod, "HTMLTableCellElement")]

public class Accommodation : IAccommodation {
    [ModdingProperty]
    public string Name { get; set; }
    public string Url { get; set; }
}
```
Host annotates view classes as PLACEHOLDERS

```csharp
<%@ Page Language="C#" MasterPageFile="~/Views/Shared/ICWE.master" %>
<asp:Content ContentPlaceHolderID="contentPlaceHolder" Runat="Server">
  ...
  <% foreach (Accommodation acc in (IList<Accommodation>)ViewData["Accommodation"] ) %>
  <tr>
    <td class="text"><%=acc.Name%> <%=acc.Stars%>*<br/>...</td>
  ...
  <%=(((Dictionary<Accommodation, String>)ViewData["AddViewModAccommodation"])[acc]) %>
</tr>
<% } %>
...
</asp:Content>
```
Partners’ contribution

Website

MODDING INTERFACE

Partner’s contribution


public interface IPlugin {}

public class HotelPlugin : IPlugin {

    [InheritedExport]
    public interface IPlugin {}

    public class HotelPlugin : IPlugin {
        [InheritedExport]
        public interface IPlugin {}

        public interface IPlugin {}
Use of Modding Interface

Partners CONSUME host PROVIDED data

```csharp

public interface IPlugin {}

public class HotelPlugin : IPlugin {
    IProfile profile; IList<IAccommodation> accommodations; bool done;
    IModdingConceptProfile Profile; IModdingConceptAccommodation Accommodation;

    public HotelPlugin(IModdingConceptProfile i1, IModdingConceptAccommodation i2) {
        Profile = i1; Accommodation = i2;
        accommodations = new List<IAccommodation>(); done = false;
        Profile.load += new EventHandler<LoadProfileEvent>(loadProfileHandler);
        Accommodation.load += new EventHandler<LoadAccommodationEvent>(loadAccommodationHandler);
    }

    void loadProfileHandler(object sender, LoadProfileEvent loadProfileEvent) {
        profile = loadProfileEvent.getCurrentTarget();
        barceloPersonalization();
    }

    void loadAccomodationHandler(object sender, LoadAccomodationEvent loadAccomodationEvent) {
        accommodations.Add(loadAccomodationEvent.getCurrentTarget());
        barceloPersonalization();
    }

    void barceloPersonalization() {
        foreach (IAccommodation accommodation in accommodations) {
            if (!done && profile != null &&
                profile.RegistrationType.Equals("Passport") &&
                accommodation.Name.Equals("Barceló Costa Vasca")) {
                AddViewModAccommodationEvent ev =
                    new AddViewModAccommodationEvent(accommodation, "<td class="text">"<a href="\"
                    Accommodation.OnSignal(ev); done = true;
            }
        }
    }
}
```
Use of Modding Interface

Partners FACILITATE content to be put in the
PLACEHOLDER

```csharp
using System; using System.Collections.Generic; using System.Linq; using System;

public interface IPlugin {}

public class HotelPlugin : IPlugin {
    IProfile profile; IList<IAccommodation> accommodations; bool done;
    IModdingConceptProfile Profile; IModdingConceptAccommodation Accommodation;

    public HotelPlugin(IModdingConceptProfile i1, IModdingConceptAccommodation i2) {
        Profile = i1; Accommodation = i2;
        accommodations = new List<IAccommodation>(); done = false;
    }

    public void loadProfileHandler(object sender, LoadProfileEvent loadProfileEvent) {
        profile = loadProfileEvent.getCurrentTarget();
        barceloPersonalization();
    }

    public void loadAccomodationHandler(object sender, LoadAccomodationEvent loadAccomodationEvent)
    accommodations.Add(loadAccomodationEvent.getCurrentTarget());
    barceloPersonalization();

    void barceloPersonalization() {
        foreach (IAccommodation accommodation in accommodations) {
            if (!done && profile != null &&
                profile.RegistrationType.Equals("Passport") &&
                accommodation.Name.Equals("Barceló Costa Vasca")) {
                AddViewModAccommodationEvent ev =
                    new AddViewModAccommodationEvent(accommodation, "<td class="text">n/a</td>"");
                Accommodation.OnSignal(ev); done = true;
            }
        }
    }
```
The Modding Interface notion is realized as an “annotation” library for .NET.

Technical feasibility has been proved through the ICWE case study.
Target: Fans

Degree of novelty

- Truly differentiating
- Basic for the business
- Commodity

Wasting valuable development resources

Intra-company
- Closed
- Shared

Inter-company
- Open

Public
- Openness of cooperation
- Openness of source code

Typical technology life
- Innovation with value appropriation

Losing intellectual property

Open source
Fans love Do It Yourself (DIY)

UK Internet visits to DIY and furniture retailers

- House and garden: DIY (Cust. Cat.)
- House and garden: furniture (Cust. Cat.)

Monthly market share in 'All Categories', measured by visits, based on UK usage.

Fans love JavaScript

Job Trends from Indeed.com

Percentage of Matching Job Postings

Jan '06 Jan '07 Jan '08 Jan '09 Jan '10 Jan '11 Jan '12
Fans love DIY + JavaScript

<table>
<thead>
<tr>
<th>Name</th>
<th>Rating</th>
<th>Posts</th>
<th>Fans</th>
<th>Installs</th>
</tr>
</thead>
<tbody>
<tr>
<td>vkontakte extender</td>
<td>12 reviews</td>
<td>25</td>
<td>33</td>
<td>252058765</td>
</tr>
<tr>
<td>Vkontakte extender / Расширение функционала Вконтакте</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestore Bacheca Farmville (FarmVille Wall Manager)</td>
<td>4 reviews</td>
<td>7</td>
<td>5</td>
<td>60308481</td>
</tr>
<tr>
<td>Manages farmville wall posts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keep Tube: Download Youtube Videos in HD and co...</td>
<td>97 reviews</td>
<td>40</td>
<td>348</td>
<td>51323998</td>
</tr>
<tr>
<td>Download Youtube Videos (HD 1080p &amp; 720p/HQ MP4, Mp3, FLV, 3GP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dailymotion (HQ MP4, FLV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magavideo (HD/HQ FLV) Google (HQ MP4, FLV), Vimeo (HQ MP4, FLV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break (HQ MP4, FLV), Veoh (HQ MP4, FLV), Metacafe, Spike, Myspace, Facebook, Current, Redtube and...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ikariam Upgrade Watcher (v1.3.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A case study: ICWE Website

Webmaster provides default paper details
A case study: ICWE Website

Fan modifies papers information with content relevant for himself
Augmented Reality
Web Augmentation

---

**Book Burro**

- Abebooks: $25.20
- Amazon: $27.89
- Amazon Marketplace: $22.30
- Buy: $30.67
- Half.com: $22.49
- Powells: $25.00

**Average Customer Review**: ★★★★★ (51 customer reviews)

**Amazon Best Sellers Rank**: #5,568 in Books (See Top 100 in Books)
  - #5 in Books > Computers & Technology > Web Development & Design > Programming > JavaScript
  - #8 in Books > Computers & Technology > Programming > Software Design, Testing & Engineering
  - #12 in Books > Computers & Technology > Web Development & Design > Web Design

---

Did we miss any relevant features for this product? **Tell us what we missed.**

Would you like to **update product info**, **give feedback on images**, or **tell us about a lower price**?

---

**More About the Author**

- Visit Amazon's David Flanagan Page
Web Augmentation Architecture

**Server**
- Website
  - Presentation Model
  - Navigation Model
  - Domain Model
  - User Model
  - Adaptation Model
  - HTML

**Client**
- Augmentator
  - DOM INTERFACE
Research Question

How to isolate fans from upgrades in the website pages?
Architecture

Server
Website
HTML
Augmentator

Client
Augmentator

MODDING INTERFACE
DOM INTERFACE
Modding Interface revisited

Changes in the web page do not break Mods

*It shields Mods from Website “design decisions that are likely to change”*
Accepted Full Papers

- A Component-based Approach for Engineering Enterprise Mashups
  Javier López, Fernando Bellas, Alberto Pan, and Paula Montoto
  ★★★ICWE DBLP Pubs: 2 -- Total DBLP Pubs: 16

- A Higher Order Generative Framework for Weaving Traceability Links into a Code Generator for Web Application Testing
  Piero Fraternali and Massimo Tisi
  ★★★ICWE DBLP Pubs: 11 -- Total DBLP Pubs: 96

- A Quality Model for Mashup Components
  Cinzia Cappiello, Florian Daniel, and Maristella Matera
  ★★★ICWE DBLP Pubs: 2 -- Total DBLP Pubs: 22
Specification of Modding Interface

Webmaster adds hyperlinks to the HTML head

- Description
- Implementation
Use of Modding Interface

Fans create Mods based on Modding Interface
Evaluation

The Modding Interface notion is realized as a JavaScript library.

Technical feasibility has been proved through the ICWE case study.
Laymen love Do It Yourself (DIY)

UK Internet visits to DIY and furniture retailers

- House and garden: DIY (Cust. Cat.)
- House and garden: furniture (Cust. Cat.)

Monthly market share in 'All Categories', measured by visits, based on UK usage.
Laymen DO NOT love JavaScript

Will you fall in love with this?

```javascript
// ==UserScript==
// ... 
// @include http://www.amazon.com/*
// ... 
// ==/UserScript==
window.addEventListener("load", function(){
    // Checking structural condition (STICKLET'S SELECTBRICK)
    var isbns=document.evaluate("//li[contains(b/text(),'ISBN-10')]", document, null, XPathResult.ANY_TYPE, null);
    var nodes=[];
    for(var elem=isbns.iterateNext();elem!=null;elem=isbns.iterateNext())
        {nodes[nodes.length]=elem;}
    // For each document portion fulfilling the structural condition
    for(var i=0;nodes.length>i;i++)
        {var isbnNode=nodes[i];
         // Checking content condition (STICKLET'S EXTRACTCONTENT,AS)
         var isbn=isbnNode.innerHTML.match(new RegExp("ISBN-10:\b (\d{10})\b"))[1];
         if(isbn!=null){
             // Adding the augmentation lever (STICKLET'S INLAYLEVER,AT)
             var link=document.createElement("a");
             link.innerHTML="Price At BookBye for "+isbn;
             isbnNode.appendChild(link);
             // Listen to the user interaction (STICKLET'S ONTRIGGERINGLEVERBY)
             _link.addEventListener("click",function(){
                 // Invoking augmentation service (STICKLET'S LOADNOTE)
                 GM_xmlhttpRequest({
                     method: "GET",
                     onload: function(response) {
                         if(response.status!=200){alert("Error: "+response.statusText);return;}
                         // Rendering service response, encapsulated in "visualize" call (STICKLET'S STICKNOTE)
                         var bookBurroPanel=visualize(response.responseText,
                             "/span[@id='ctl00_ContentPlaceHolder1_lblBestNew']","\."),
                             ad.appendChild(bookBurroPanel);
                         },
                         onerror:function(response){alert("Server Not Exist:"));}
                     },true)
                     [link,isbnNode,isbn]]},true);
```
A case study: Buy a book at the best price

Price of book at Amazon
$31.04

Price of book at BookByte
$13.31
$27.75
$37.51
How to facilitate user participation?
// ==UserScript==
// ...
// @include http://www.amazon.com/*
// ...
// ==UserScript==
window.addEventListener("load", function() {
  // (STICKLET)
  // Script scope: structural condition + content condition on the current document
  // Checking structural condition (STICKLET'S SELECTBRICK)
  var isbns=document.evaluate("//li[contains(b/text(),'ISBN-10')]",
    document, null, XPathResult.ANY_TYPE, null);
  var nodes=[];
  for(var elem=isbns.iterateNext();elem!=null;elem=isbns.iterateNext())
    {nodes[nodes.length]=elem;}
  // For each document portion fulfilling the structural condition
  for(var i=0;nodes.length>i;i++)
  {var isbnNode=nodes[i];
    // Checking content condition (STICKLET'S EXTRACTCONTENT, AS)
    var isbn=isbnNode.innerHTML.match(new RegExp("ISBN-10:<b/>(\d{10})") ) [1];
    if(isbn!=null)
      // Adding the augmentation lever (STICKLET'S INLAYLEVER, AT)
      var link=document.createElement("a");
      link.innerHTML="Price At BookByte for "+isbn;
      isbnNode.appendChild(link);
      (function(_link, _ad, _isbn) {
        // Listen to the user interaction (STICKLET'S ONTRIGGERINGLEVERBY)
        _link.addEventListener("click", function() {
          // Invoking augmentation service (STICKLET'S LOADNOTE)
          GM_xmlHttpRequest{
            method: "GET",
            onload: function(response) {
              if(response.status==200){alert("Error: "+response.statusText);return;}
              // Rendering service response, encapsulated in "visualize" call (STICKLET'S STICKNOTE)
              var bookBurroPanel=visualize(response.responseText,
                "<span[@id='ctl00_ContentPlaceHolder1_lblBestNew']">(.*)";
                _ad.appendChild(bookBurroPanel);
              ),
              onerror:function(response){alert("Server Not Exist.");}
            });
          }(_link, isbnNode, isbn));
        });
      });
Sticklet

A Domain Specific Language for Web Augmentation

```javascript
// ==UserScript==
// ...
// @onekin:sticklet
// @sticklet:twitter
// @sticklet:facebook
// ==/UserScript==
StickletBox([ Sticklet("Price At BookByte for $isbn").
  WhenOnWall("*.amazon.com/*").
  SelectBrick("//li[contains(b/text(),'ISBN-10')]").
  ExtractContent("ISBN-10:<b> \{d\[10\]\}\ As\("\$isbn\).".
  // number in list element after "ISBN-10:"
  InlayLever("link").At("after","\$isbn").
  OnTrigginingLeverBy("click").
  SelectBrick("//span[@id='...lblBestNew']").
  ExtractContent("(*)\ As\("\$price\)." // text
  StickNote("\$price").
```
The Sticklet notion is realized as an add-on for Firefox

https://addons.mozilla.org/firefox/addon/addon/Sticklet/
Evaluation

Technical feasibility has been proved

http://userscripts.org/users/290853/scripts

Technical features have been proved.

http://userscripts.org/users/290853/scripts

Technical feasibility has been proved.
Usability study was conducted for two roles (Producers & Consumers)
Producers’ Satisfaction

- Consider Interesting: 4.62
- Avoid Back&Forth: 4.11
- Think Help Keep Focus: 3.95
- No Errors During Use: 3.72
- Install Other sticklets: 3.72
- Plan Develop in Future: 3.94
To conclude
Conclusions

Web content growth + Web user diversity growth = Stringent Web personalization demands

Stringent Web personalization demands + Limited IT resources = Not all user requirements can be foreseen / afforded
Conclusions

OPEN PERSONALIZATION:

Allows users to personalize the Web
Conclusions

The diagram illustrates the relationship between contribution value, company engagement, and user affordance across different levels of computer literacy and programming experience. The x-axis represents levels of computer literacy, ranging from "Computer Literate (Public)" to "Professional Programmer (Inter-Company)". The y-axis shows the engagement levels, categorized as "High", "Medium", and "Modest". The contribution value is indicated by the diagonal line, suggesting that as computer literacy and programming experience increase, so does the value contributed and engagement with the company.

The diagram highlights the following key points:

- At the "Computer Literate (Public)" level, engagement is at its lowest, indicating a modest contribution value.
- At the "Professional Programmer (Inter-Company)" level, engagement is at its highest, corresponding to a high contribution value.
- The "Hobby Programmer" level falls in between, indicating a medium contribution value.

The diagram emphasizes the importance of bridging the gap between computer literacy and engagement to maximize contribution value.
Conclusions

• Partners’ Personalization allows Webmaster to open the Website to its partners
  – Webmaster defines the Modding Interface
  – Partners build Mods using such interface

• Future Work
  – Extension of User Model by the partners
  – Partner-based permission mechanism
Conclusions

• Fans’ Personalization allows Webmaster to open the Website to fans
  – Webmaster defines the Modding Interface
  – Fans build Mods using such interface

• Future Work
  – Promote contribution
  – Include Mods in the core
Conclusions

• Laymen’s Personalization allows end-users to modify the Web
  – Producers can create and share Mods
  – Consumers can use Mods safely

• Future Work
  – Web Augmentation in mobile devices
  – Apply Programming by Demonstration techniques
On the opening to partners

Cristóbal Arellano, Oscar Díaz and Jon Iturrioz.

Acceptance rate: 20.4%.

Oscar Díaz, Cristóbal Arellano and Jon Iturrioz.

On the opening to fans

Oscar Díaz, Cristóbal Arellano and Jon Iturrioz.
Interfaces for Scripting: Making Greasemonkey Scripts Resilient to Website Upgrades.
In ICWE 2010.
Acceptance rate: 20.0%.

Cristóbal Arellano, Oscar Díaz and Jon Iturrioz.
In WISE 2010.
Acceptance rate: 18.8%.

Cristóbal Arellano, Oscar Díaz and Jon Iturrioz.
The Modding Web: Layman Tuning of Websites.
In ICWE 2009. (DOCTORAL SYMPOSIUM)
On the opening to laymen

Oscar Díaz, Cristóbal Arellano and Maider Azanza. A Language for End-user Web Augmentation: Caring for Producers and Consumers Alike. Accepted at the ACM Transactions on the Web 2013.

Other Publications

Oscar Díaz, Cristobal Arellano, Gorka Puente.  
*Wikipedia Customization through Web Augmentation Techniques.*  
In WikiSym 2012.  
Acceptance rate: 55.0%.

Oscar Díaz, Josune de Sosa, Cristóbal Arellano and Salvador Trujillo.  
*Web-Based Tool Integration: A Web Augmentation Approach.*  
In ICWE 2012.

Oscar Díaz, Gorka Puente, Cristóbal Arellano.  
*Wiki Refactoring: An Assisted Approach Based on Ballots.*  
In WikiSym 2011.  
Acceptance rate: 42.0%.
Other Publications

Oscar Díaz, Jon Iturrioz and Cristóbal Arellano. *Facing Tagging Data Scattering.* In WISE 2009. Acceptance rate: 23.0%.


“It is the mark of an educated mind to be able to entertain a thought without accepting it.” Aristotle