A Domain Ontology to Support Evidence-Based Practice and Context Usage on Crime Prevention

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Guide of Presentation

- Introduction
- Background
  - Context
  - Evidence-Based Practice
- A Meta-model to Represent Context and Evidence-Based Practice
- A Domain Ontology for the Crime Prevention
- Application to the Crime Prevention Scenario
- Conclusion
Evidence-Based Practice (EBP)

- is employed in several areas: Medicine, Crime Prevention, Education, Software Engineering and Social Work

- take into account
  - a problem being faced by an actor (e.g. diabetes in children)
  - his/her needs and preferences for decision
  - and an application based on the best research evidence found (Sacket et al. 2001)

- represents a process centered on the justification of relevant evidences (Dobrow et al., 2004)
Introduction

- **Context**
  - “supports the ability to define what is or is not relevant in a given situation” (Vieira, 2008)
  - “applies to filter and share more useful information so that this information can meet the needs of the users” (Bunningen, 2004)

- **Evidence and Context**
  - fundamental components of an evidence-based decision (Dobrow et al. 2004)
  - Application of evidence
    - important contextual information in the EBP
    - comparative analysis between different contexts (e.g. generation of evidence and patient)

- There is research in EBP and context fields. But, the integration in computer models is still an open issue
Ontology

- is referred as the shared understanding of some domains
- is often conceived as a set of entities, relations, functions, axioms and instances

Ontology and Context

- One main reason for developing context models based on ontology is knowledge sharing that enables computational entities (human or software agent) to find similar profiles in decision making environment (Wang et al. 2004).
Objectives

To present a meta-model that integrates evidence with context concepts for domains that use EBP.

To describe a domain ontology to support the search and retrieval of evidence on crime prevention, regarding decision-making context.

To use contextual information as filtering mechanisms to optimize performance and reduce search results with view to reapply decision-making justifications when similar problems occur.
Definition: “a set of information items associated with an entity” (Vieira, 2008)

An item corresponds to a contextual element defined as “any data, information or knowledge that enables one to characterize an entity on a given domain” (Vieira, 2008)

Contextual entity
- represents the entities of the application conceptual model
- is characterized by at least one contextual element

Focus
- represents one step in the task execution or problem-solving process
- Is executed by human or software agent
Evidence-Based Practice

Definition of “Evidence” (or “Research evidence”): “it is a proof based from published research that corresponds to critical reviews of the investigated area” (Thomas and Pring, 2004)

EBP Involves complex decision-making based on:
- available research evidence
- Values and preferences of the actor
- practical experience from decision-maker

Primary focus
- Medical area: to help patients with terminal or chronic illness to extend or increase the quality of their life (Friedland et al., 1998)
- Crime prevention area: to aim reducing the recidivism of offenders, considering risk, needs and treatment principles (Warren, 2007)
Background

Evidence-Based Practice

Procedures

- Formulating question
  - Problem/Actor
  - Intervention
  - Comparison
  - Outcome

- Searching the best evidence
  - Primary studies
  - Secondary studies

- Evaluating the evidence
  - Is it valid?
  - Is it relevant?
  - Can it help? (Is it useful?)

- Decision-making
  - How much is it help the actor of the problem in particular?
  - Is it adaptable to goal and preferences of the actor?
  - How much safety can be expected?

- Evaluating own performance
  - How can we proceed better next time?
A Meta-model to Represent EBP and Context

- It provides a class structure
- It represents information related to EBP procedures taking into consideration its decision-making context

- Domains analysed: juridical, medical and educational
- Activities realized
  - bibliographical and specific legislation research
  - analysis of real cases collected
  - interviews with decision-makers

- Its presentation have two integrated packages
  - Context package
  - Evidence package
A Meta-model to Represent EBP and Context
A Domain Ontology for the Crime Prevention

*ContextualEntity* class

- Concepts based on a survey concepts related found in the technical and scientific literature
A Domain Ontology for the Crime Prevention

**ContextualEntity class**

<table>
<thead>
<tr>
<th>Subclass</th>
<th>Contextual Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge</td>
<td>hasExpertAffinity</td>
<td>identifies a relation of expertise from the Judge profile on a given subject matter (e.g. crimes against children). It helps to identify mutual affinities among judges optimizing performance and reducing search results.</td>
</tr>
<tr>
<td>Participant</td>
<td>hasAbilities</td>
<td>represents the defendant’s or victim’s skills, and is used to find mutual affinities with intervention programs (e.g. revenue). Reduce search results.</td>
</tr>
<tr>
<td>Defendant</td>
<td>hasPotentialRisk</td>
<td>comes from juridical and psychosocial evaluations (profile). Behavior data, conduct, fact description and given sentences, especially for recurrent cases, are bases to characterize an offender’s degree of risk.</td>
</tr>
<tr>
<td>JuridicalFact</td>
<td>hasCircumstances</td>
<td>describes the information about time and geographic aspects for the occurred fact. Information about number of people involved and their attitudes are desirable too. It is relevant and determinant to understand the juridical fact.</td>
</tr>
<tr>
<td>Researched Document</td>
<td>hasValidity</td>
<td>indicates whether the document should be selected based on its quality and the methodological rigor associated with the question asked by the decision maker (judges, in this case).</td>
</tr>
<tr>
<td></td>
<td>hasRelevance</td>
<td>indicates whether the set of results (outcomes) in the document, often presented in statistical form, is consistent and significant.</td>
</tr>
<tr>
<td>Evidence</td>
<td>hasApplicability</td>
<td>indicates whether the evidence presented in the document is credible in the context of other knowledge, or whether it has practical utility in general.</td>
</tr>
<tr>
<td>Restorative Intervention</td>
<td>hasAdaptability</td>
<td>indicates the degree of coherence in the application of evidence for the conducted behavior, needs and preferences of the defendant (or victim).</td>
</tr>
<tr>
<td></td>
<td>hasSafety</td>
<td>denotes the percentage of safety that the judge have to apply the specific evidence to a particular participant (defendant or victim).</td>
</tr>
<tr>
<td></td>
<td>hasExpectation</td>
<td>refers to the percentage of support expected from the use of evidence in relation to the participant (defendant or victim).</td>
</tr>
</tbody>
</table>
A Domain Ontology for the Crime Prevention

**ConventionalEntity** class

- Contains all the specific subclasses of the domain, which does not have a direct influence of context.
A Domain Ontology for the Crime Prevention

**Inference Rule**

- *Intervention program rule for victims*
  - citizenship, psychosocial and psychiatric
  - Obs: for offenders, any program is permitted

- *Rule to retrieve evidence-based solutions centered on the judge's specialty*
  - the research solution space can be reduced based on: his/her expertise; two specialties; or all experts

- *Rule to find documents with evidence based in query keyword*
  - query terms are verified with documents keywords that detains at least one similar words
Application for the Crime Prevention Scenario

Environment and System
- The Pernambuco state court, Recife, Brazil
- Criminal Justice System
- Requirement: to make interventions based on programs with the objective to avoid recidivism

Case
- Problem: a victim with panic syndrome suffered violence of an alcoholic offender
- Solution perspective → intervention program with face-to-face restorative justice
- Support programs: psychosocial and psychiatric treatments
- Justification: many offenders suffered violence in the past and victims could be turn offenders in the future (Sherman et al, 2005)
## Application for the Crime Prevention Scenario

### Evidence Retrieval - Local Database

<table>
<thead>
<tr>
<th>Title</th>
<th>Keywords</th>
<th>Study Character</th>
<th>Source Character</th>
<th>San Exam</th>
<th>Expertise</th>
<th>Concha</th>
<th>Situ Cha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drunk and dangerous: a randomized controlled trial of alcohol</td>
<td>alcohol, brief interventions, violence, randomized</td>
<td>Springer Y</td>
<td>75</td>
<td>90</td>
<td>drug crimes</td>
<td>high</td>
<td>concl</td>
</tr>
<tr>
<td>Reducing violence through victim identification care and support</td>
<td>violence, crime victims rehabilitation, health police</td>
<td>World He</td>
<td>0.0</td>
<td>0.0</td>
<td>homicide</td>
<td>ongo</td>
<td></td>
</tr>
<tr>
<td>Assessing the effectiveness of interventions designed to support the</td>
<td>victims of crime, systematic review, violence,</td>
<td>Campbell</td>
<td>80</td>
<td>85</td>
<td>crimes against women</td>
<td>mod</td>
<td>concl</td>
</tr>
<tr>
<td>Change in behaviour of alcohol consumption: what is the motivational</td>
<td>alcoholism, motivation, gastroenterology, outpatient</td>
<td>National</td>
<td>60</td>
<td>50</td>
<td>drug crimes</td>
<td>mod</td>
<td>concl</td>
</tr>
<tr>
<td>Effects of Drug Substitution Programs on Offending among Drug</td>
<td>drug substitution, drug-addicts, alcohol dependence</td>
<td>Campbell</td>
<td>80</td>
<td>85</td>
<td>drug crimes</td>
<td>low</td>
<td>concl</td>
</tr>
<tr>
<td>Police crackdowns on illegal gun carrying: a systematic review</td>
<td>Campbell Collaboration, crackdowns, violence</td>
<td>Springer Y</td>
<td>80</td>
<td>85</td>
<td>homicide</td>
<td>high</td>
<td>concl</td>
</tr>
<tr>
<td>Cognitive-Behavioural Interventions for Children Who Have Been</td>
<td>child sexual abuse, victim, cognitive-behavioral therapy</td>
<td>Campbell</td>
<td>85</td>
<td>80</td>
<td>crimes against child</td>
<td>mod</td>
<td>concl</td>
</tr>
<tr>
<td>School-Based Education Programmes for the Prevention of Child</td>
<td>child sexual abuse, victim, school-based education</td>
<td>Campbell</td>
<td>70</td>
<td>80</td>
<td>crimes against child</td>
<td>low</td>
<td>concl</td>
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<td>mod</td>
<td>concl</td>
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Application for the Crime Prevention Scenario
Evidence Retrieval from Springer Verlag

- **Question**
  - P: woman with psychological problem who was assaulted
  - I: face-to-face sessions
  - C: interventions face-to-face and conventional processes
  - O: beneficial effects
- **Sources:** Campbell Collaboration and Springer Verlag

![Evidence Retrieval over the Internet - Research](image.png)
### Evaluate the Evidence

<table>
<thead>
<tr>
<th># Research</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td># Seek</td>
<td>2</td>
</tr>
<tr>
<td>Doc: Location</td>
<td><a href="http://www.springerlink.com/content/wq27gu7n60t41">http://www.springerlink.com/content/wq27gu7n60t41</a></td>
</tr>
<tr>
<td>Title</td>
<td>Effect of face-to-face restorative justice on victims of crime</td>
</tr>
<tr>
<td>Author</td>
<td>Sherman, L.W; Strang, H; Angel, C; Woods, D; Barnes, G</td>
</tr>
<tr>
<td>Keywords</td>
<td>restorative justice; face-to-face meeting; crime victim;</td>
</tr>
<tr>
<td>Source</td>
<td>Springer Verlag Study meta-analysis Publication 2005</td>
</tr>
<tr>
<td>Sample</td>
<td>Two randomized controlled trials (RCT) included violence (100 offenders &lt; 30) and personal property (173 offenders &lt; 18) conducted in Canberra, Australia, from July 1995 to June 2000; and two RCT treated robbery and burglary</td>
</tr>
<tr>
<td>Evidence</td>
<td>The restorative justice (RJ) rituals succeeded in producing an outcome judged by the victims to be a successful recommitment to group morality - between 10 and 100 times more likely with RJ than without it. The victims assigned to RJ (average = 76%) were 'satisfied' with the conference. The consistently larger effect sizes for the experiments for apologizes in Figure 1 (page 387)</td>
</tr>
<tr>
<td>Suggested</td>
<td>The face-to-face meetings must be conducted by police officers. All of them have to receive a four-day training course. Training consists of both restorative justice theory and role-play practice at conducting the sessions. Victims and offenders are urged to bring friends and family to the conference.</td>
</tr>
<tr>
<td>Valid</td>
<td>yes</td>
</tr>
<tr>
<td>Relevant</td>
<td>yes</td>
</tr>
<tr>
<td>Applicable</td>
<td>yes</td>
</tr>
<tr>
<td>EBP step</td>
<td>3</td>
</tr>
<tr>
<td>Confirm</td>
<td></td>
</tr>
</tbody>
</table>
Application for the Crime Prevention Scenario

Decision Making

<table>
<thead>
<tr>
<th>Decision Making</th>
<th>Actor:</th>
<th>Defendant</th>
<th>Victim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Maria Rita Lopes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct</td>
<td>married, 2 children, universitarian, seller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviour</td>
<td>timid, drink socially, with panic syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs</td>
<td>psychological and psychiatric support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abilities</td>
<td>oil-painting, gardener, cook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Tuesday and Wednesday; 8:00 - 10:00 am</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In relation to actor - evidence:

- Adaptable: yes
- Safety: 80%
- Expectation: 60%

Intervention

It was established that the victim will participate in face-to-face meetings with the offender, provided that the police authorities will be present. Police men are in training to attend the protocol of this new modality. The meeting will be scheduled with ten sessions. One hour per session. Each two sessions, the technical team will evaluate the intervention performance. Psychological and psychiatric support must be effectuated weekly.

Program: psychosocial psychiatric

EBP step 4 Confirm
Conclusion

- The meta-model
  - integrates context with evidence
  - serves to support system designers facilitating the development of applications centered in EBP considering the decision-making context
  - is independent of domains (that use EBP)

- The ontology
  - integrates context with evidence
  - Crime prevention domain

- The application for the crime prevention
  - filtering mechanisms using contextual information
  - Show that contextual EBP can be used to support decision making of the judges
  - aid provenance community experts
Future works

- building of task ontology for the criminal area and a high-level ontology for the areas that use EBP

- Creation of a semi-automatic Evidence-Oriented Information Extractor

- the incorporation of the classical case structure (problem, solution and result) and Case-Based Reasoning technique for decision making support
Questions