Contribution to the "synergetic convergence" between research and industry

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manual dialogue design vs. statistical dialogue management

- Industry follows the VUI-completeness principle [Pieraccini&Huerta, SIGdial 2005]

  "The behaviour of an application needs to be completely specified with respect to every possible situation that may arise during the interaction. No unpredictable user input should ever lead to unforeseeable behaviour".

- Reinforcement learning based dialogue management from fully data-driven dialogue management [Levin1998, Young2000, Lemon&Pietquin2007] to hybrid methods [Singh2002, Williams2008, Laroche2009]

dialogue evaluation : comparing vs. improving

- “how best to evaluate a dialogue system?” vs. “how best to design dialogue systems?” [Paek2007]

- Defining commensurable dialogue evaluation metrics that allow comparison of disparate SDS

  vs.

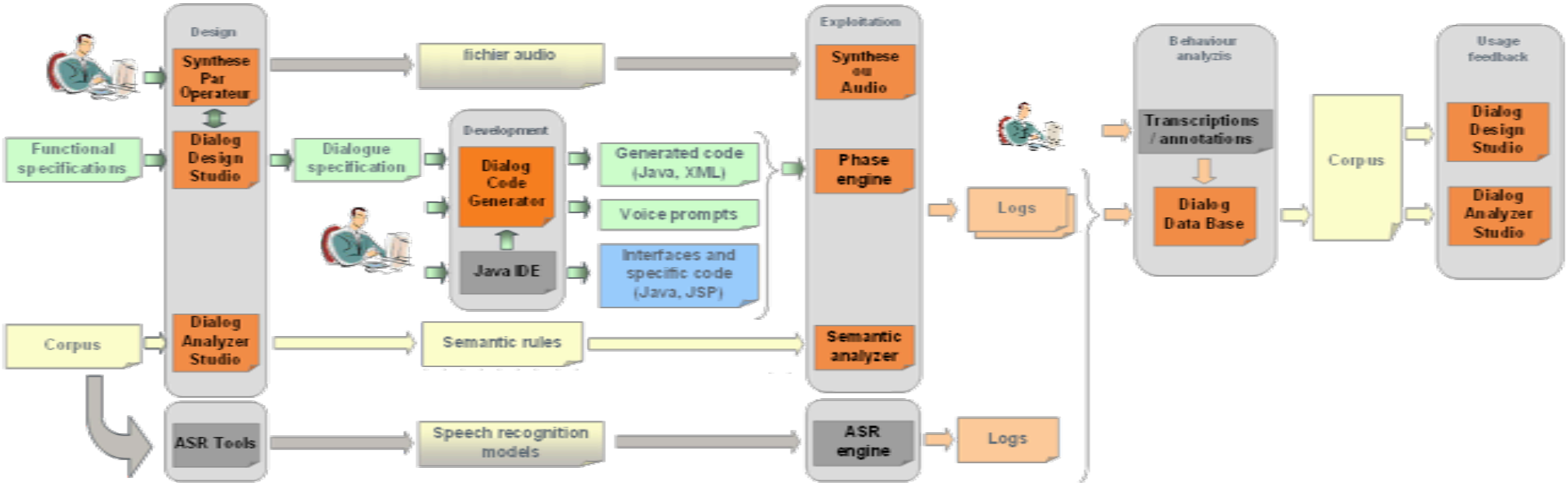
- Optimising the return-on-investment of customer services by continuously monitoring and improving the SDS in an efficient and cost-effective rationalised process

a convergent approach for a new design and evaluation experience for SDS developers

- 1. integrating dialogue evaluation functionalities into the dialogue design tool
- 2. allowing the design of dialogue alternatives
- 1+2. attempting to reassess the dialogue evaluation
- 3. adding reinforcement learning to automate the choices among dialogue alternatives

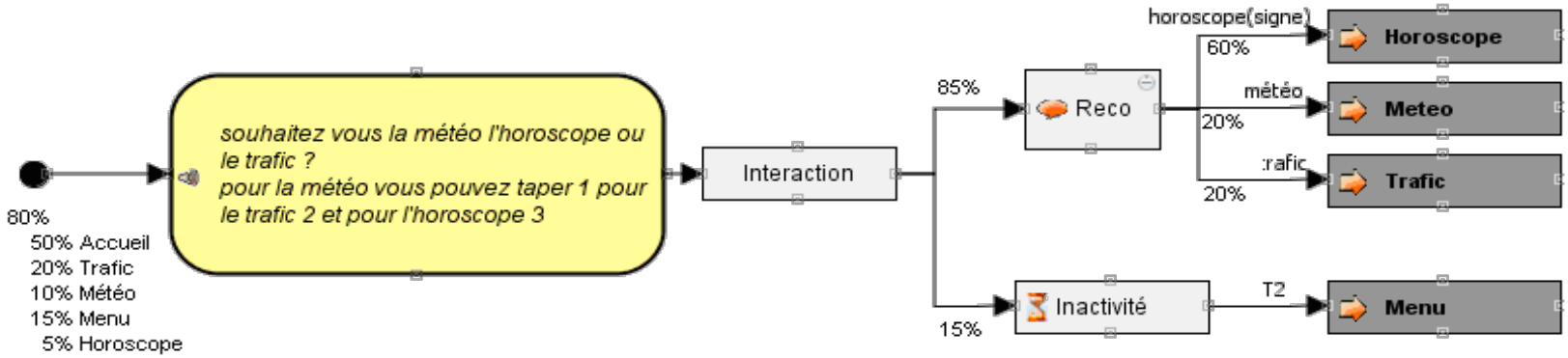
What SDS developers need?

- SDS developers need a trustable complete set of simple and standard tools covering the whole spoken dialogue system life cycle
- a controlled and deterministic development process allows the spoken dialogue industry to reach a balance between usability and cost



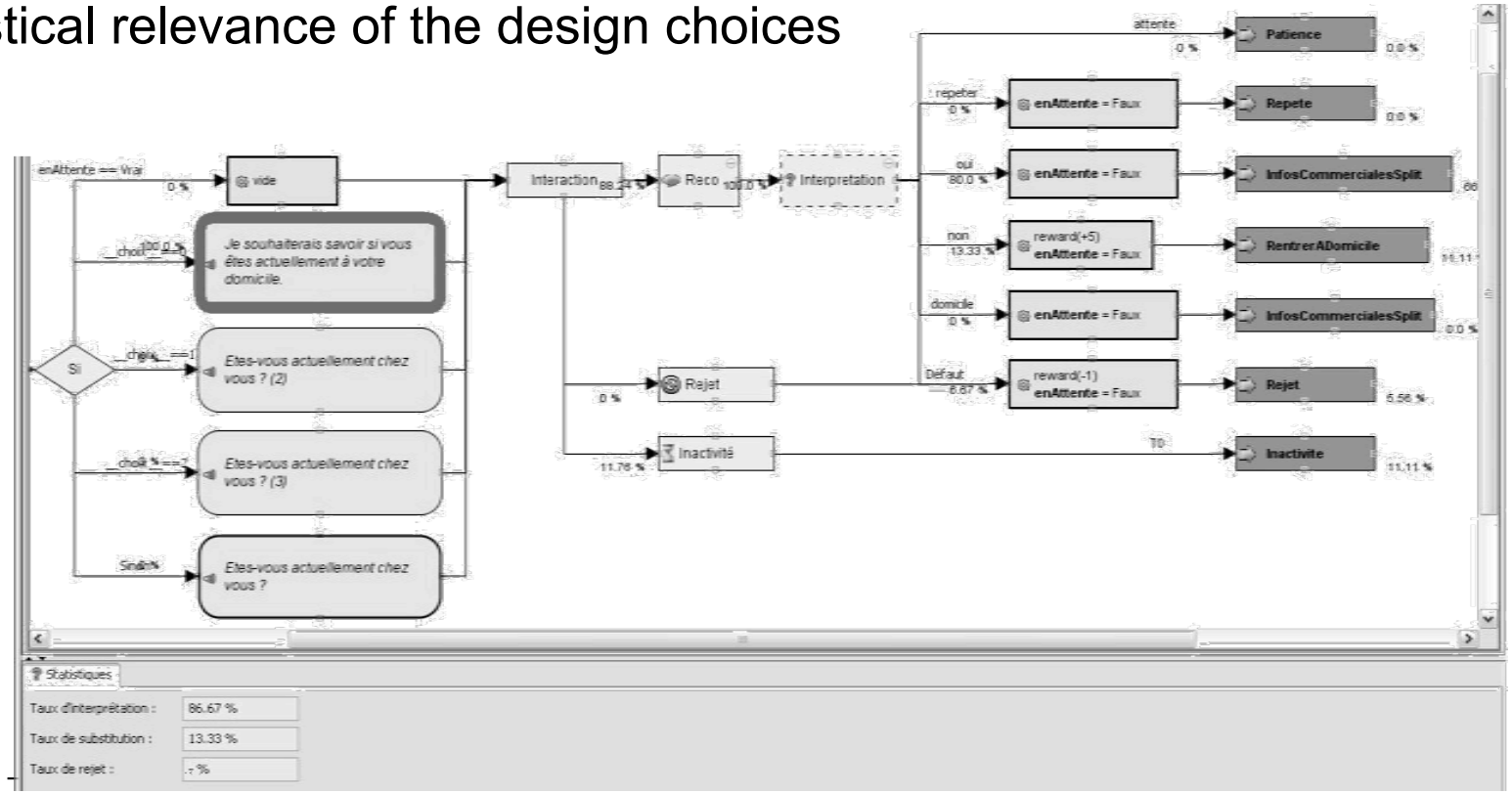
1. integrating dialogue evaluation functionalities into the dialogue design tool

- logs feedbacks are directly integrate into the design tool
- numerous performance indicators can be interactively monitor
- “user experience feedback” makes the developers able to check if their predictions conform to the measured user experience while designing the SDS



2. allowing the design of dialogue alternatives

- multiple dialogue alternatives can be designed
- competing designs are tested simultaneously (multivariate testing)
- this minimizes the SDS developers' intuitions and improves the statistical relevance of the design choices



1+2. attempting to reassess the dialogue evaluation

- The traditional reference frame for SDS evaluation is the user, but
  - dialogues are unique co-built performances, and
  - the user adapts very quickly compared to SDS
- What about shifting the reference frame?
  - the reference frame becomes the design and the expected value range of performance indicators
  - this reference frame is both stable and entirely under control
  - deviations from the predicted situations automatically warn about issues in the dialogue design

3. adding reinforcement learning to automate the choices among dialogue alternatives

- reinforcement learning automatically chooses the best design alternatives

- SDS developers and the learning algorithm work complementarily
  - SDS developers work at the whole application and the macro-strategic level
  - the learning algorithm works at the local level

  - the learning algorithm do the real-time support and optimisation
  - SDS developers monitor the system behaviour at each improvement cycle

  - The learning algorithm is concentrated on the alternative sets and automatic evaluation and ignores the rest
  - SDS developers may have access to additional information through annotations, or user subjective evaluations

- SDS developers can easily monitor, understand, control and trust the learning algorithm

conclusion

- dialogue design tools, monitoring tools and dedicated reinforcement learning algorithms are complementary and offer a trustable convergent experience to industrial developers in designing and evaluating spoken dialogue systems

- undergoing works: the tools and the methodology are being used in a real project as a beta testing
  - the productivity gain has been estimated to ~10% (the real gain will be measured at the end)
  - live use of the resulting SDS will say how the learning algorithm is efficient
  - the first subjective feedbacks from the project team are highly positive
  - the final evaluation will be: does this will be used in future projects?

Thanks for your attention

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  - reasoning method and algorithm for automating a logical theory of rational interaction [1995]
- Research engineer in the Dialogue research group at France Télécom – CNET Speech Lab
  - The ARTIMIS dialoguing rational agent [1997]
  - First industrial trails of a stock exchange application for a French Bank [1999-2002]
- Now heading the Dialogue research group at Orange Labs
  - industrial automata based dialogue technologies enhancement
  - major research topics: dialogue evaluation, dialogue design, machine learning

1st example: the white pages
impact of technological constraints

- the goal: to recognise a name (first+last or last+first)

- the analysis: a trade-off is needed
  - the white pages database size:
    several dozen of millions items, or
    several millions items per town
  - the technological limits in terms of vocabulary size:
    several millions items for a state-of-the-art isolated word speech recogniser

- the impact: the dialogue design need
  - to switch the usual (natural?) order of slots and to require to fill the "town" slot
    - usual order: last and first name, then a geographical area
      imposed order: a town, then last and first name
  - to constrain user to pronounce last and first name as isolated words

2nd example: hotline call routing
impact of human constraints

- the goal: to route user according to her reason of call and to the call centre internal organisation

- the analysis : technological performance vs. human ability and common use
  - from the technological performance viewpoint: ask the user for one keyword among the ones that cover the major division of the call centre

    Is your problem related to network, software or hardware?

    ! This supposes that the user is able to analyse the problem by herself !
  - from the common use viewpoint: the "expert" model

    Please, tell directly the reason of your call.
    For example say: "I do not have tonality anymore."

    The user expects to talk this way to a human agent.

- the impact: the dialogue design needs to respect what user abilities are and the common use

3rd example: automatic assistance to human agent

The system constraints the user to better recognise her answer

- the goal: the system has to replace the human agent when giving the user some phone number and asking her if she wants to be connected while maintaining the 50% transfer rate

- The analysis: copy human agent behaviour vs. use the priming effect
  - with the formulation that human agent used (or with small variants respecting ergonomics standards)

    Do you want to be transferred? => 41%
  - with an incentive formulation, a priming effect can be observed

    To be transferred, please say "yes" => *51%*

- The impact: the dialogue design has to condition the user to be correctly understood (classified) at the next dialogue step