

Helping end users understand and control intelligent agents

Todd Kulesza

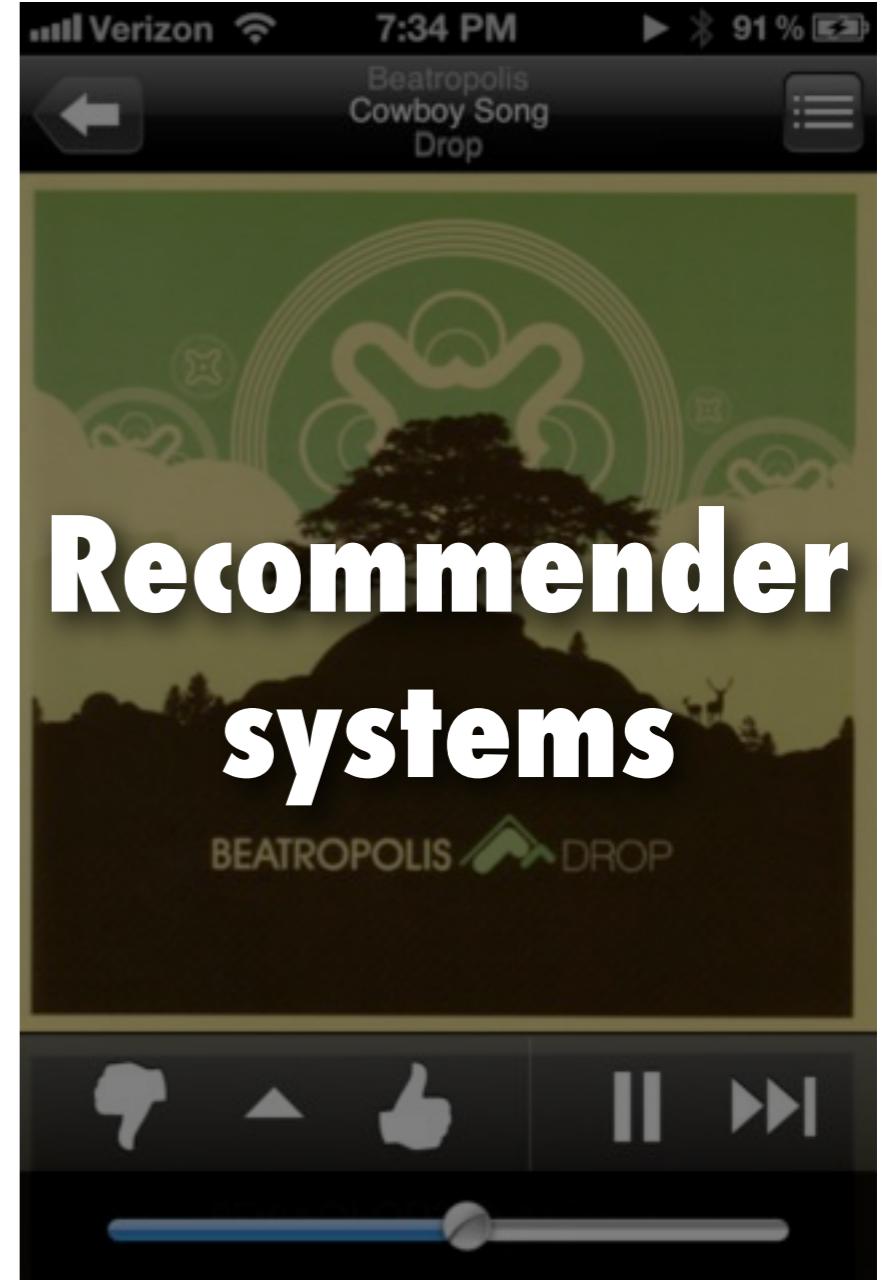


Workshop papers

- Making user interface adaptation in multi-device environments understandable to end users
[Fabio Paternò, Christian Sisti, & Giuseppe Zichitella]
- Transparency and controllability in user interfaces that adapt during run-time
[Matthias Peissner & Thomas Sellner]
- The role of explanations in assessing and correcting personalized intelligent agents
[Todd Kulesza, Margaret Burnett, Simone Stumpf, & Weng-Keen Wong]

Transparency > Adaptive interfaces > Classifiers > Recommenders

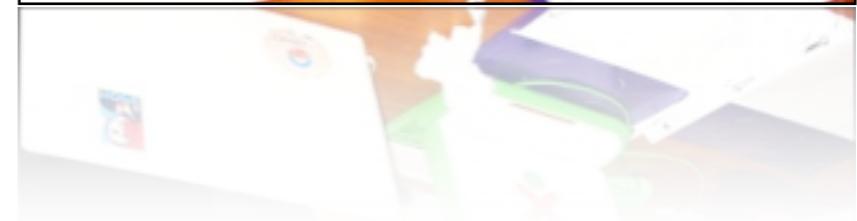
Examples of agents



Transparency > Adaptive interfaces > Classifiers > Recommenders

Problems people face

- Trust & acceptance
- Usability & consistency
- Controllability



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How can explanations of the system's features & reasoning (i.e., *transparency*) help end users?

Transparency > Adaptive interfaces > Classifiers > Recommenders

Just last week...



Is this spam?

Dear Customer,

It has come to our attention that your account Billing Information records are out of date. That requires you to update your Billing Information. Failure to update your records will result in account termination.

Click on the reference link below and enter your login information on the following page to confirm your Billing Information records...

Click on <http://store.apple.com> confirm your Billing Information records.

Thanks,
Apple Customer Support

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<http://31.210.113.211/~yeteneks/>

Transparency helps us...

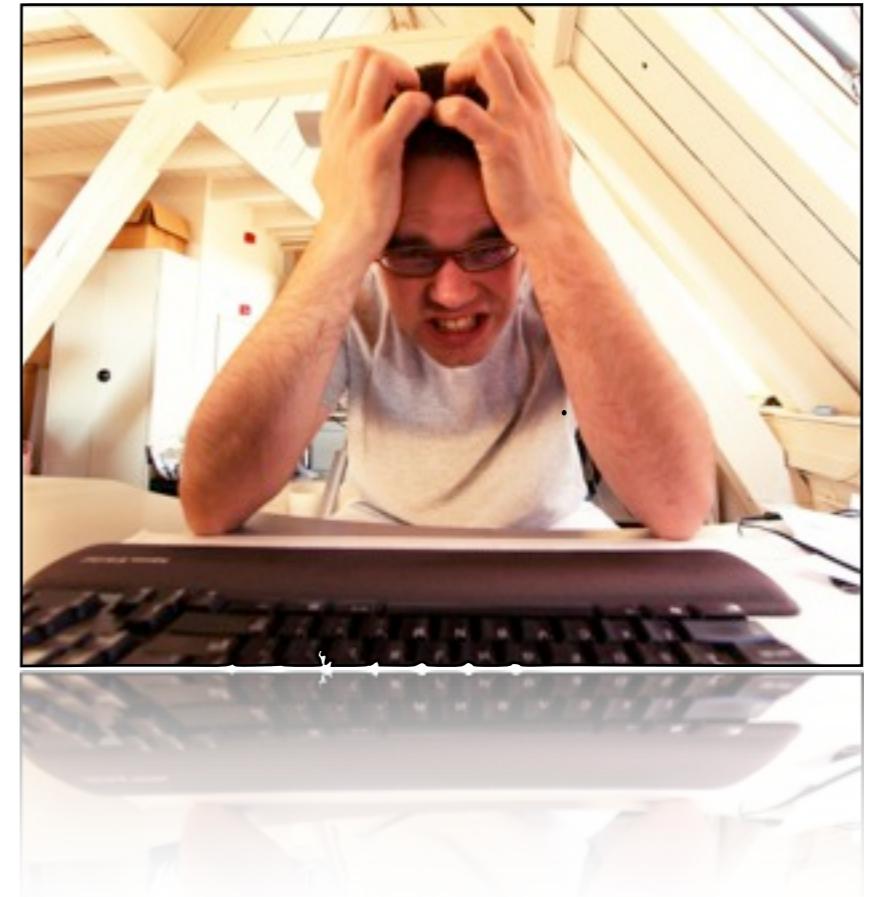
- **Understand classifiers**
[Lim et al. 2009, Kulesza et al. 2012]
- **Feel satisfied with recommendations**
[Sinha 2002]
- **Act upon recommendations**
[Herlocker et al. 2000, Cramer et al. 2008]
- **Work faster with context-aware programs**
[Dearman et al. 2007]



Transparency > Adaptive interfaces > Classifiers > Recommenders

But it also leads us to...

- Misuse agents in situations where they are unreliable
[Dzindolet et al. 2003, Lim 2012]
- Perceive a higher cost to working with the agent
[Bunt et al. 2012]



Types of transparency

Category	Type of explanation
Ontological	What is...?
Mechanistic	How does it work?
Operational	How do I use it?
Design rationale	Why does it work like this?

[Haynes et al. 2009]

Transparency > Adaptive interfaces > Classifiers > Recommenders

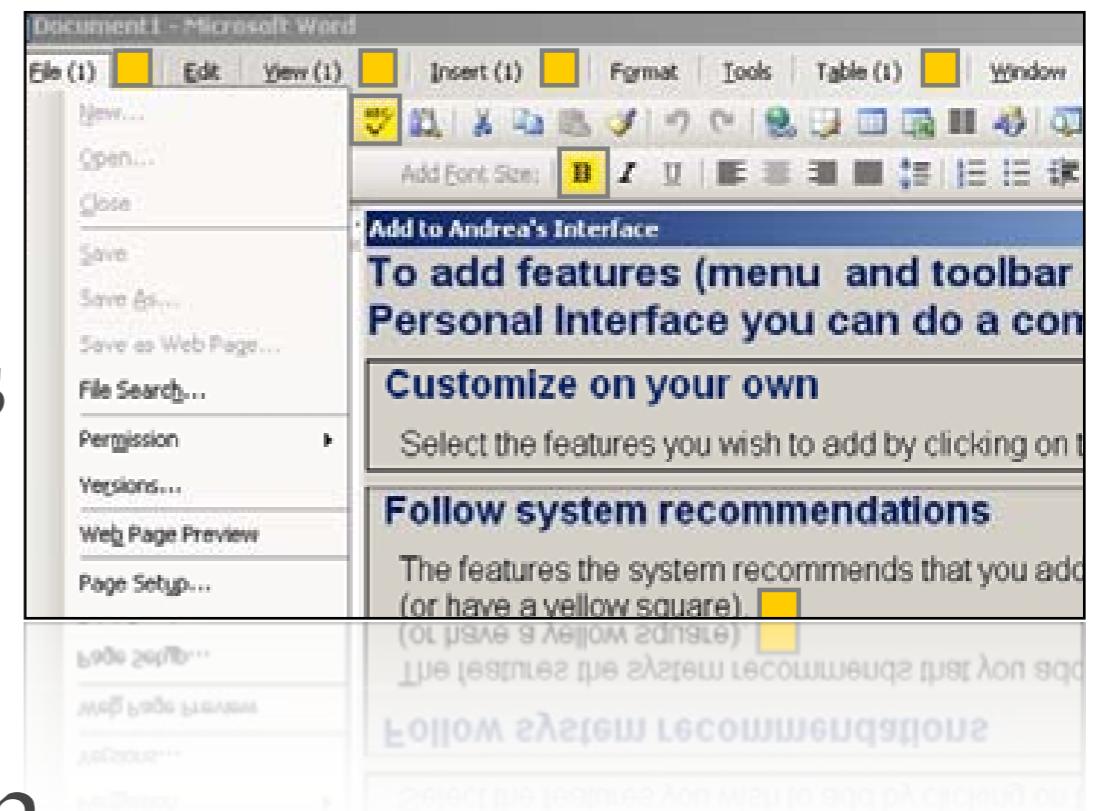
What can be transparent?

Source	Type of explanation
ML model	Static explanation of how the classifier works
ML reasoning	Dynamic explanation of what the classifier currently “thinks”
Real-world evidence	Human-observable reasons for classification (including context)

[Lacave & Díez et al. 2003]

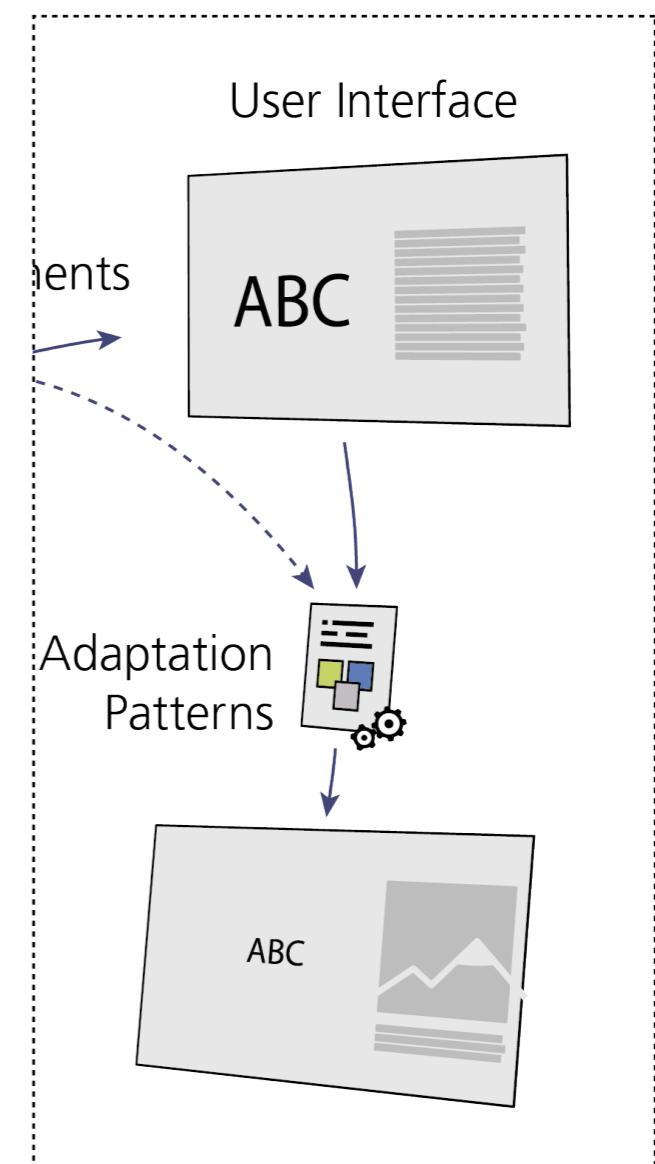
Transparent adaptations

- MICA [Bunt et al. 2007]
 - User always in control
 - Makes recommendations
- MyUI [Peissner & Sellner]
 - Mixed initiative approach
 - Customizations based on patterns



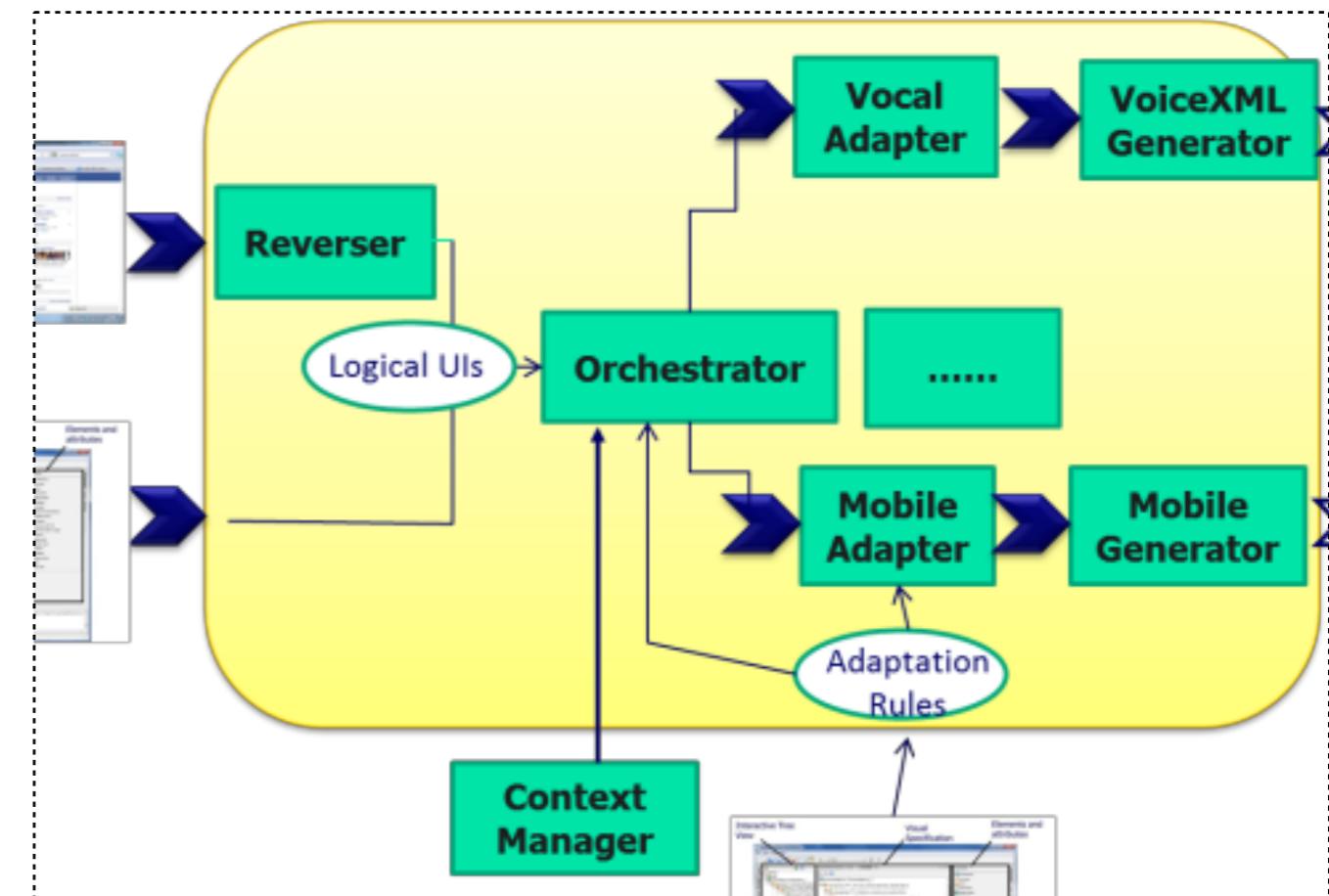
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Controlled adaptations

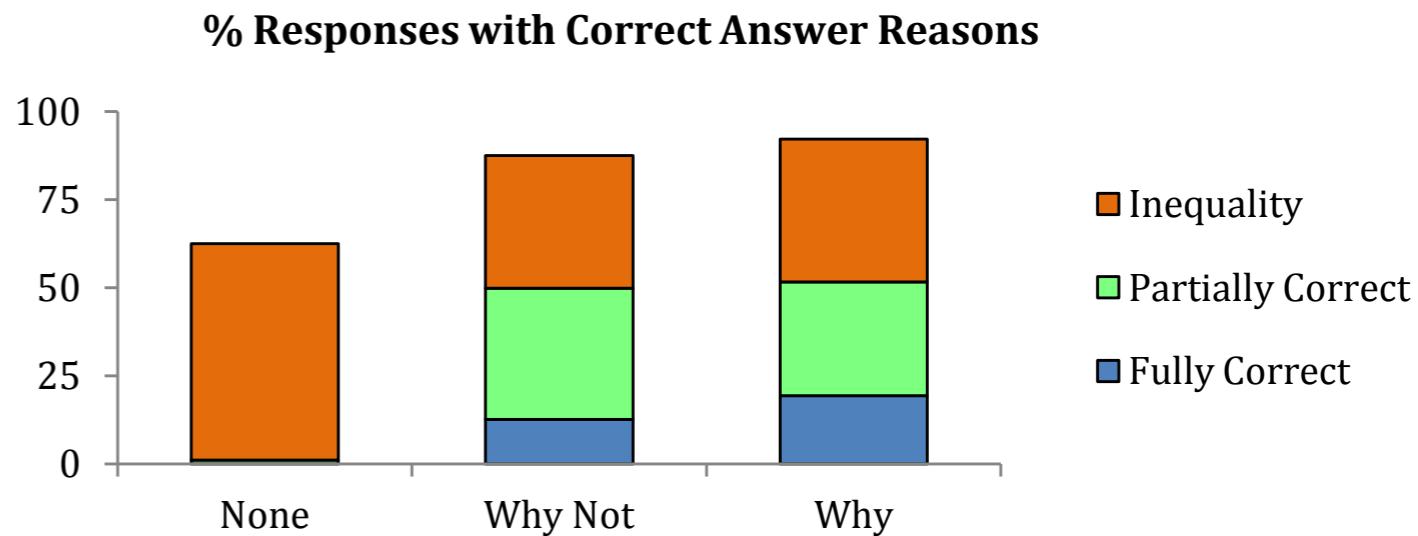
- Paternò, Sisti, & Zichitella
 - MARIA to model logical content
 - Users can specify preferences and constraints for adaptation



Transparent classifiers

- Why... explanations more effective than Why not... or How to...

[Lim et al. 2009]

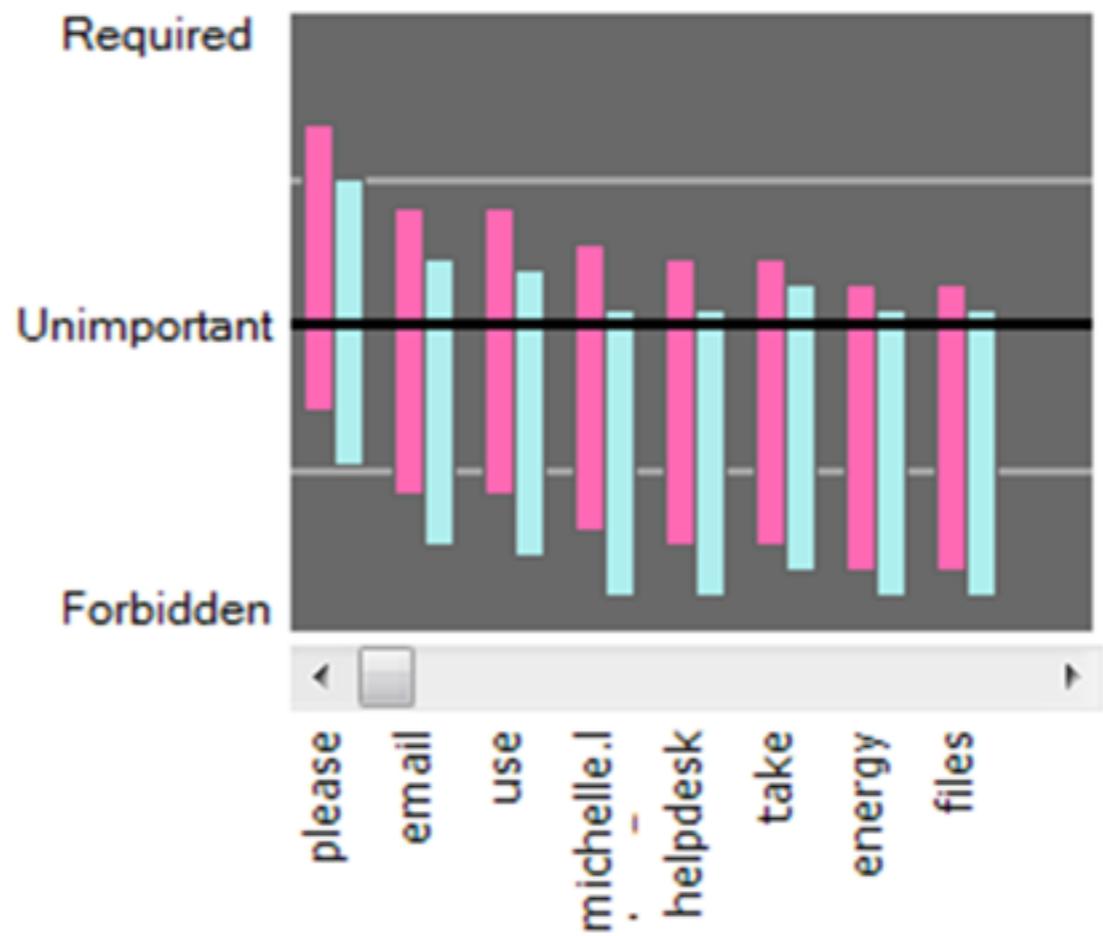


- When dimensionality is high, there are still barriers to control

[Kulesza et al. 2011]

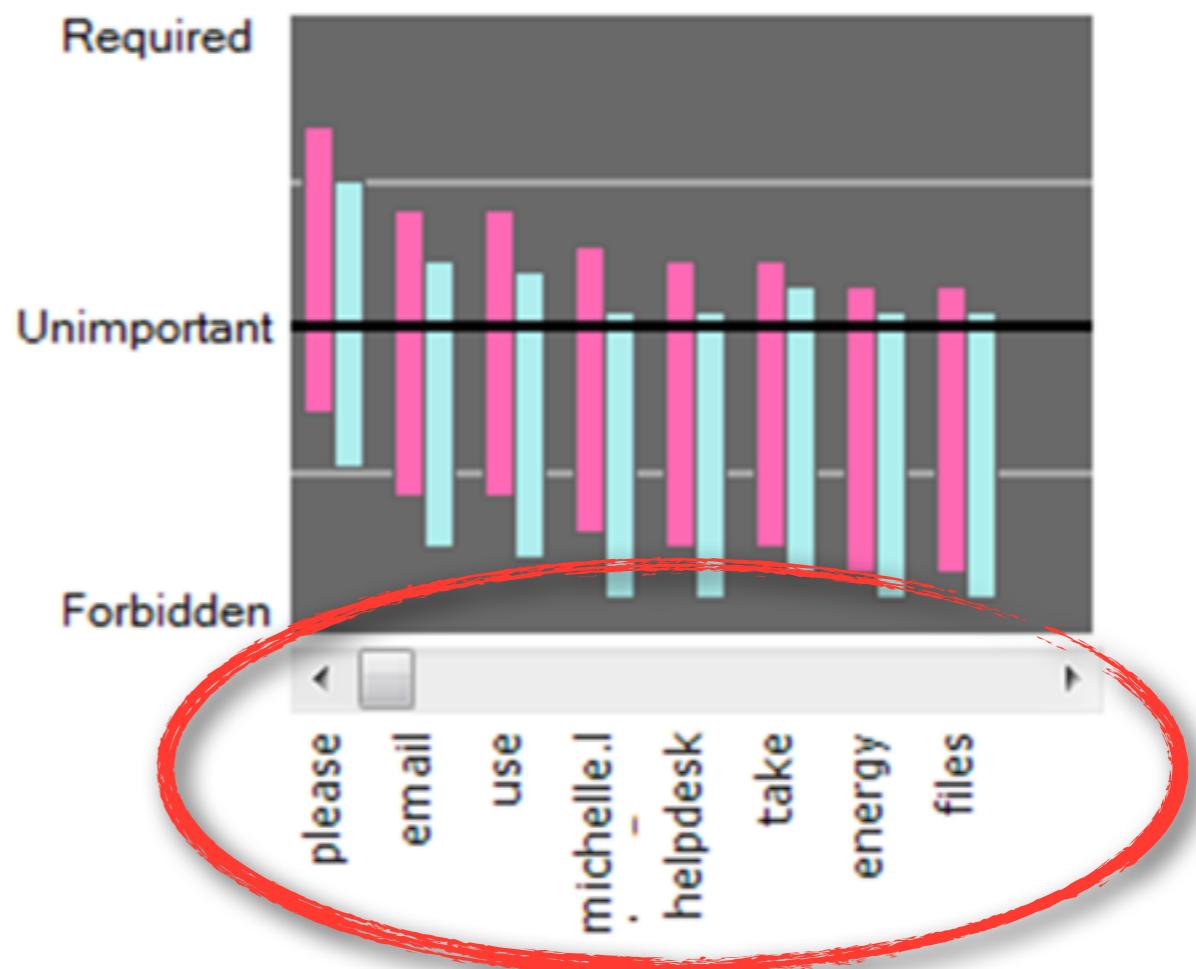
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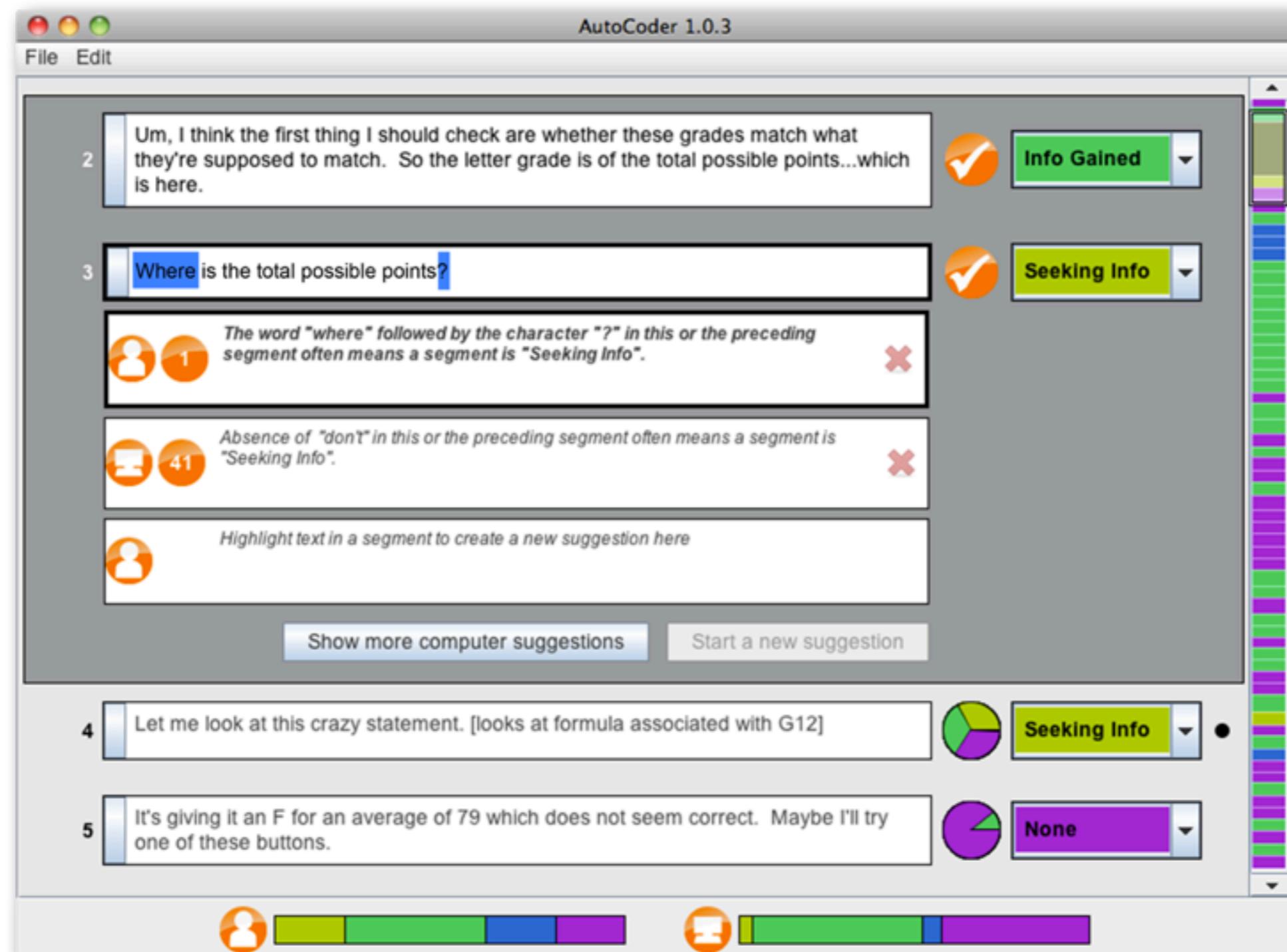


Transparent classifiers

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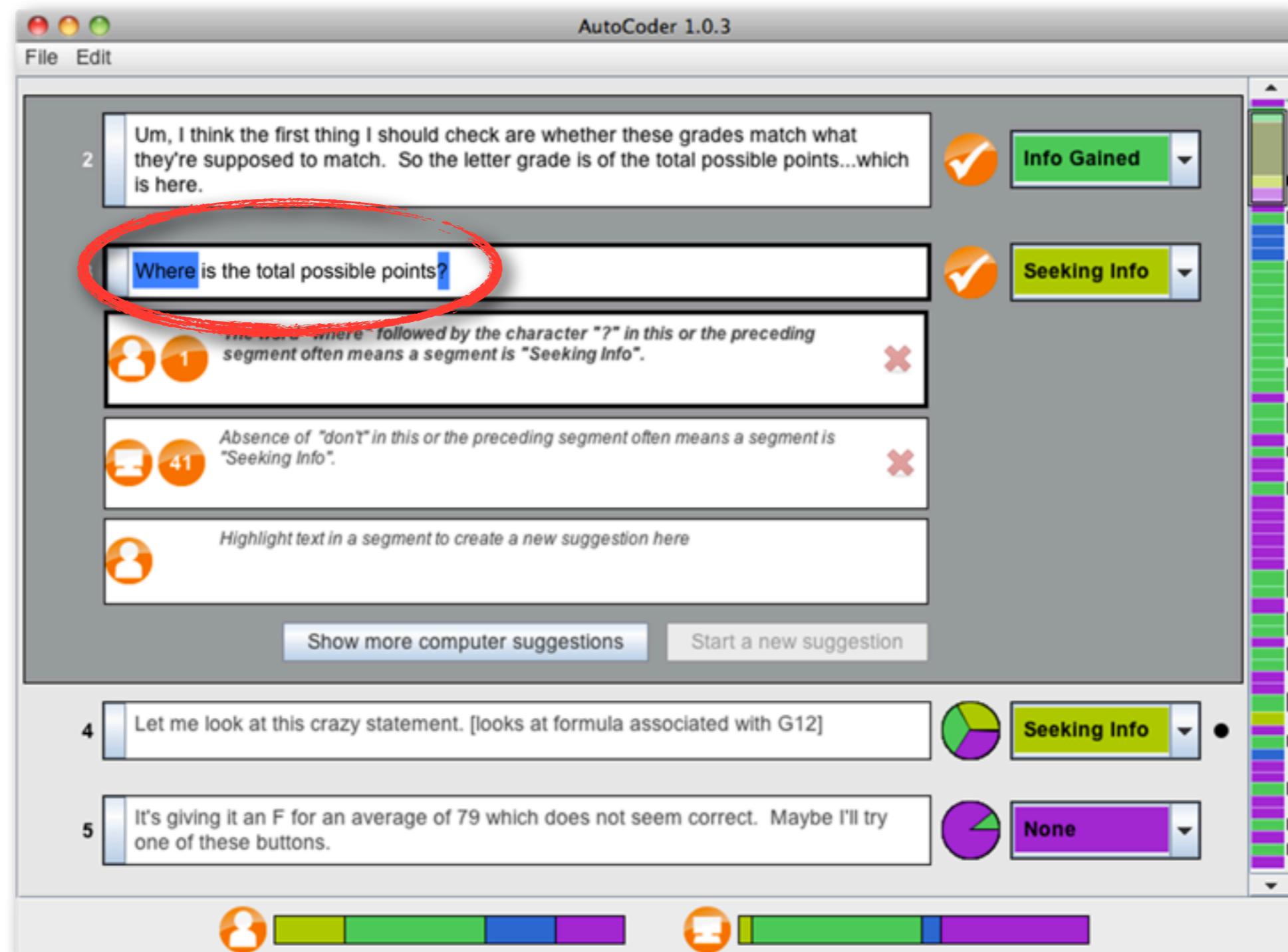


“Explanatory debugging”



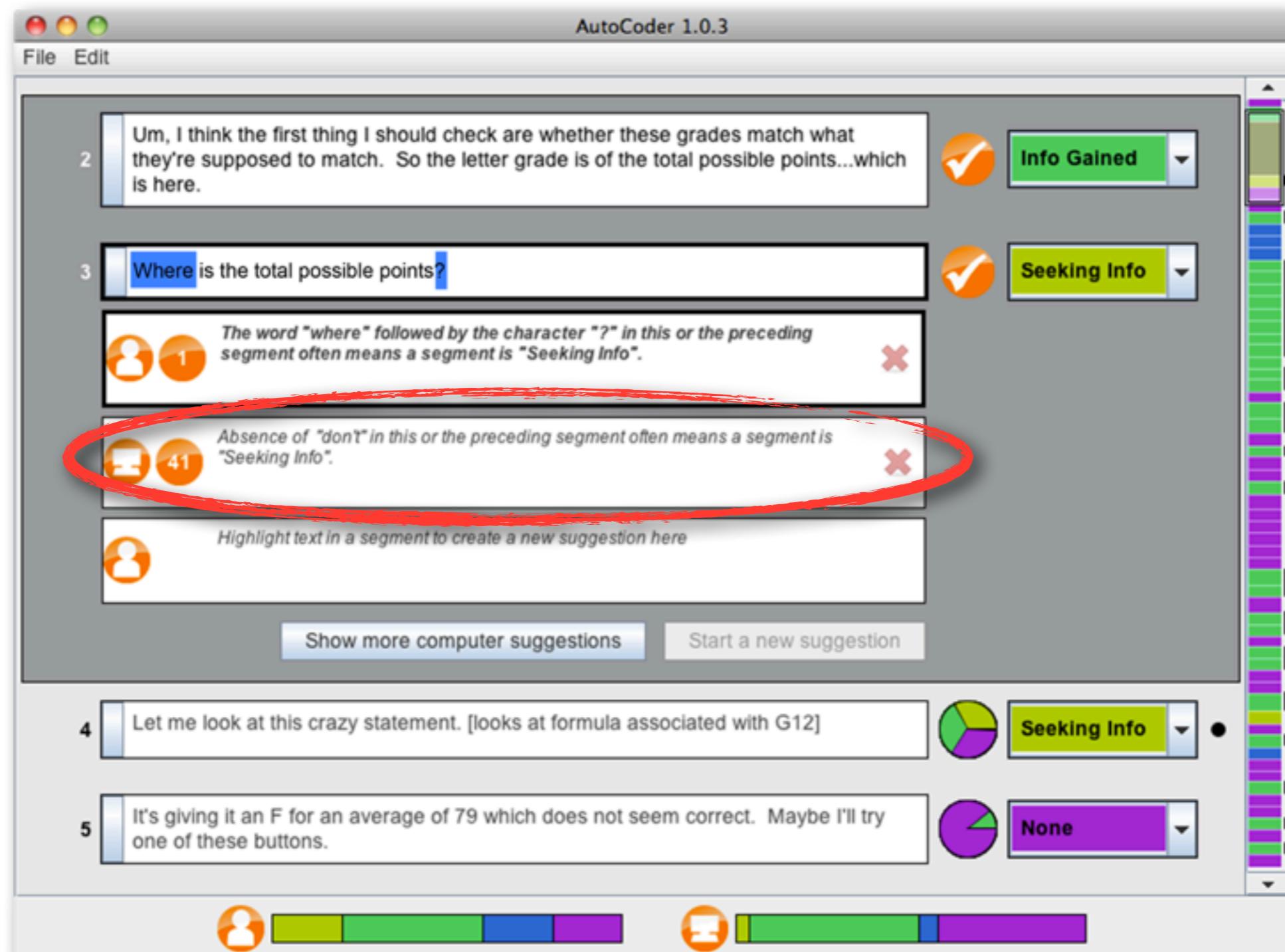
Transparency > Adaptive interfaces > **Classifiers** > Recommenders

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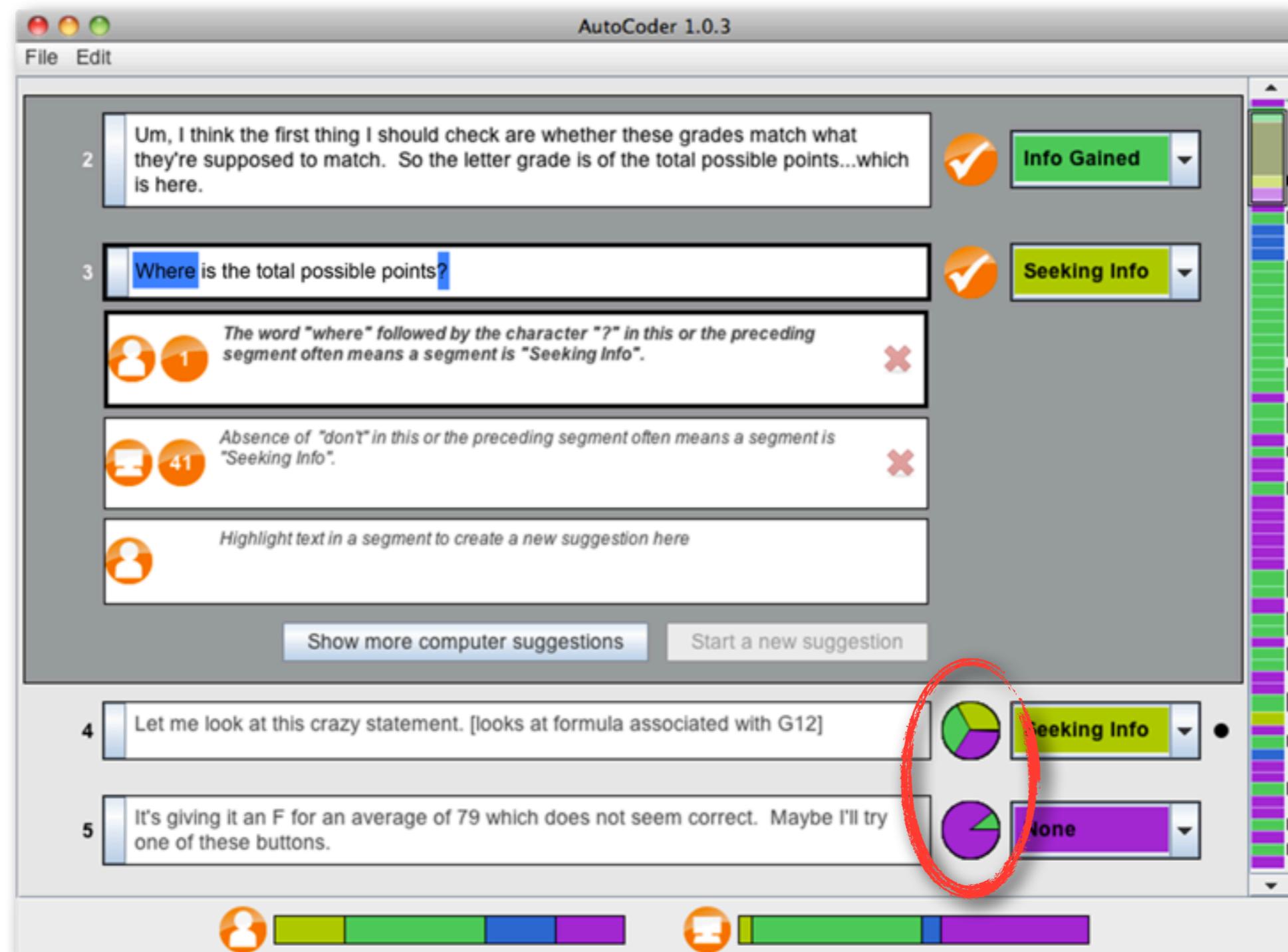
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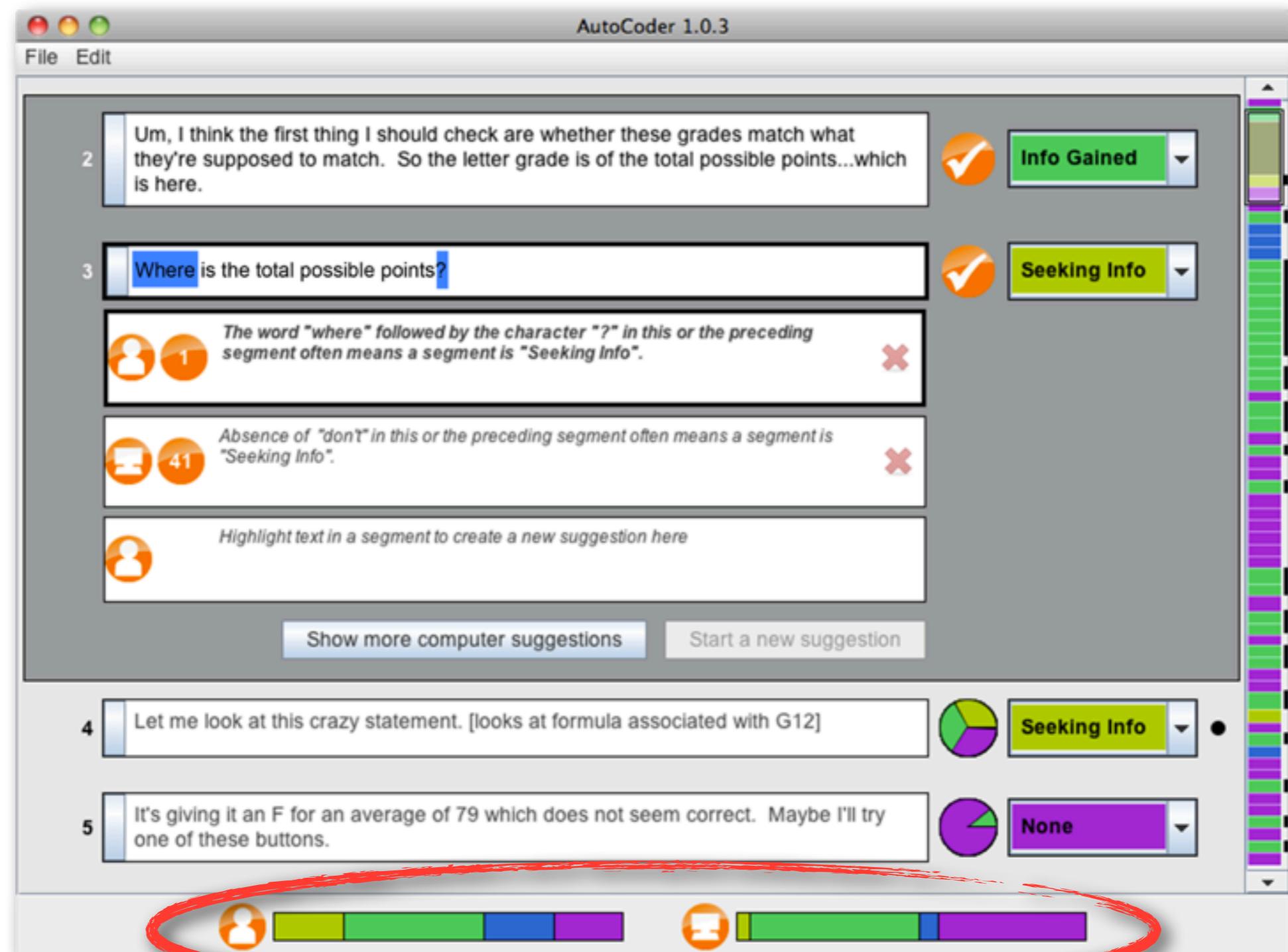
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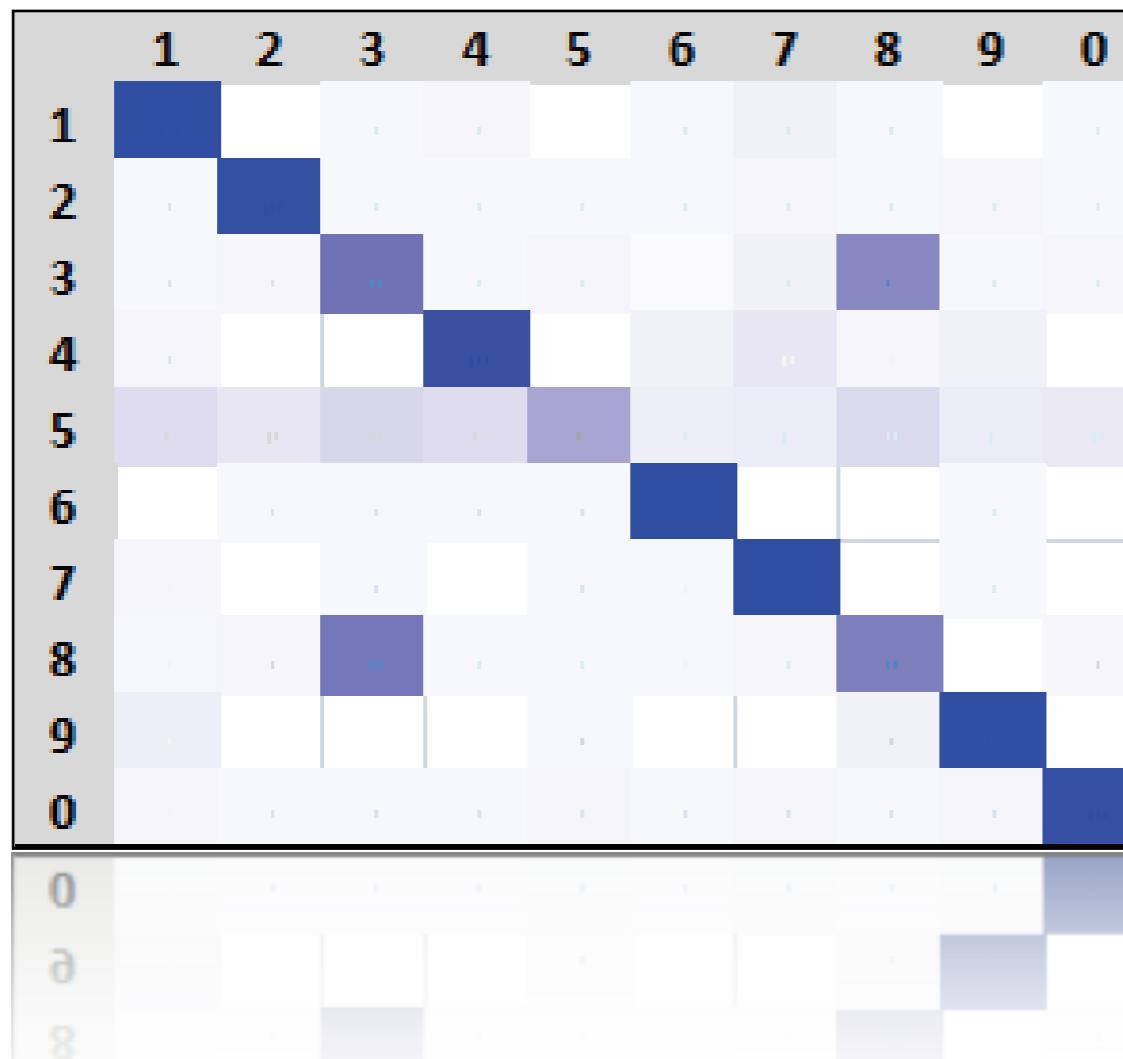


Transparency > Adaptive Interfaces > **Classifiers** > Recommenders

Other forms of transparency

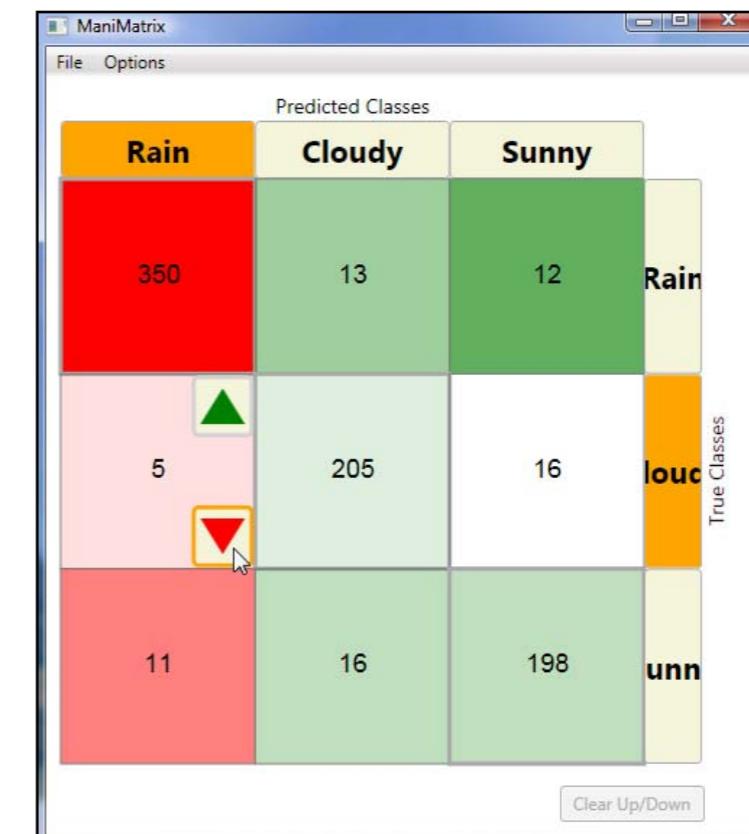
EnsembleMatrix

[Talbot et al. 2009]



ManiMatrix

[Kapoor et al. 2010]



Transparency > Adaptive interfaces > **Classifiers** > Recommenders

Transparent recommenders

- Combination of **scaffolding** and *in-situ learning* important for control
[Kulesza et al. 2012]
- **Reasons** for recommendations can increase **satisfaction** & follow-up **actions**
[Sinha 2002, Swearingen & Sinha 2002]
- Explanations can have negative impact on **expert users**
[McNee et al. 2003]

Transparency ▶ Adaptive interfaces ▶ Classifiers ▶ **Recommenders**

Steering recommenders

- Interaction effectiveness depends on **user characteristics**
[Knijnenburg et al. 2011]
- **Cost/benefit ratio** improves as users understand the system's mechanics
[Kulesza et al. 2012]

Lim's guidelines

Explanation Type		General		Application Behavior Inappropriateness		Situation Criticality		Application Goal-Support Role		Application Recommender Role		Number of Context Externalities	
				Low	High	Low	High	Low	High	Low	High	Low	High
Application Model	Input												
	Output												
	Why	✓	✓	✓	✓	✓	✓						
	Why Not			✓	✓	✓	✓						
	How	✓	✓	✓	✓	✓	✓			✓		✓	
	What If					✓	✓			✓		✓	
	What Else					✓	✓						
	Visualization	✓	✓			✓	✓	✓			✓		
	Certainty	✓				✓	✓		✓				
	Control	✓			✓		✓						
Situation													

✓ =recommended, ✓ =highly recommended

[Lim & Dey 2009]

Transparency > Adaptive interfaces > Classifiers > Recommenders

Conclusion

- How can we improve **existing techniques**?
- What works best for **end users**?
- How **generalizable** are these solutions?



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