



Mobile Speech Translation

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Fluent Automated Speech Translation



What is your pain like—
burning, stabbing,
throbbing, or dull?

The pain is stabbing.



¿Cómo es su dolor—tipo
punzada, tipo
quemadura, tipo
palpitacion, o sordo?

El dolor es punzante.



Technology Overview

- 4th generation
- 7 military deployments
- 2 successful hospital pilots
- Thin-client based
- Smartphone prototype

System

Capabilities & Limitations



- **Fast and easy to use**
 - Hands/eye Free
- **Accurate and consistent**
 - Works in high-noise environments
- **Interprets for specific jobs & settings**
 - Not the “Star Trek Universal Translator”
 - But provides significant language capabilities
- **Handles 80-90% of all common interactions for a given setting**

System Details

- **Audio to Speech Recognition (ASR)**
 - Nuance 8.5 Engine
 - Multiple Language models
 - Normally the small ASR is specific to the sub-domain/question and the large ASR covers the entire domain
- **Translation**
 - Statistical machine translation engine
 - Similar to Giza with lexical constraints and phrase alignment
 - Ability to handle multiple translation and language models
- **Template Translation**
 - Using templates to capture and translate common phrases
 - E.g., “How are you?”, “Where does it hurt?”

System Evaluation

- **Evaluation Performed at Kaiser San Francisco**
 - 3 nurses and 11 patients
 - 95 nurse-patient encounters
 - 500 conversational segments
- **User Training**
 - Each nurse was trained for 1-1.5 hours prior to system use
 - Patients received a 40 sec sound-byte on the system functionality before using it
- **System Evaluation**
 - Every utterance judged as Good, Fair, Poor, Mistranslated, or Not Translated by 2 people
 - Conflicts resolved by a 3rd person
 - Examples given in the next two slides

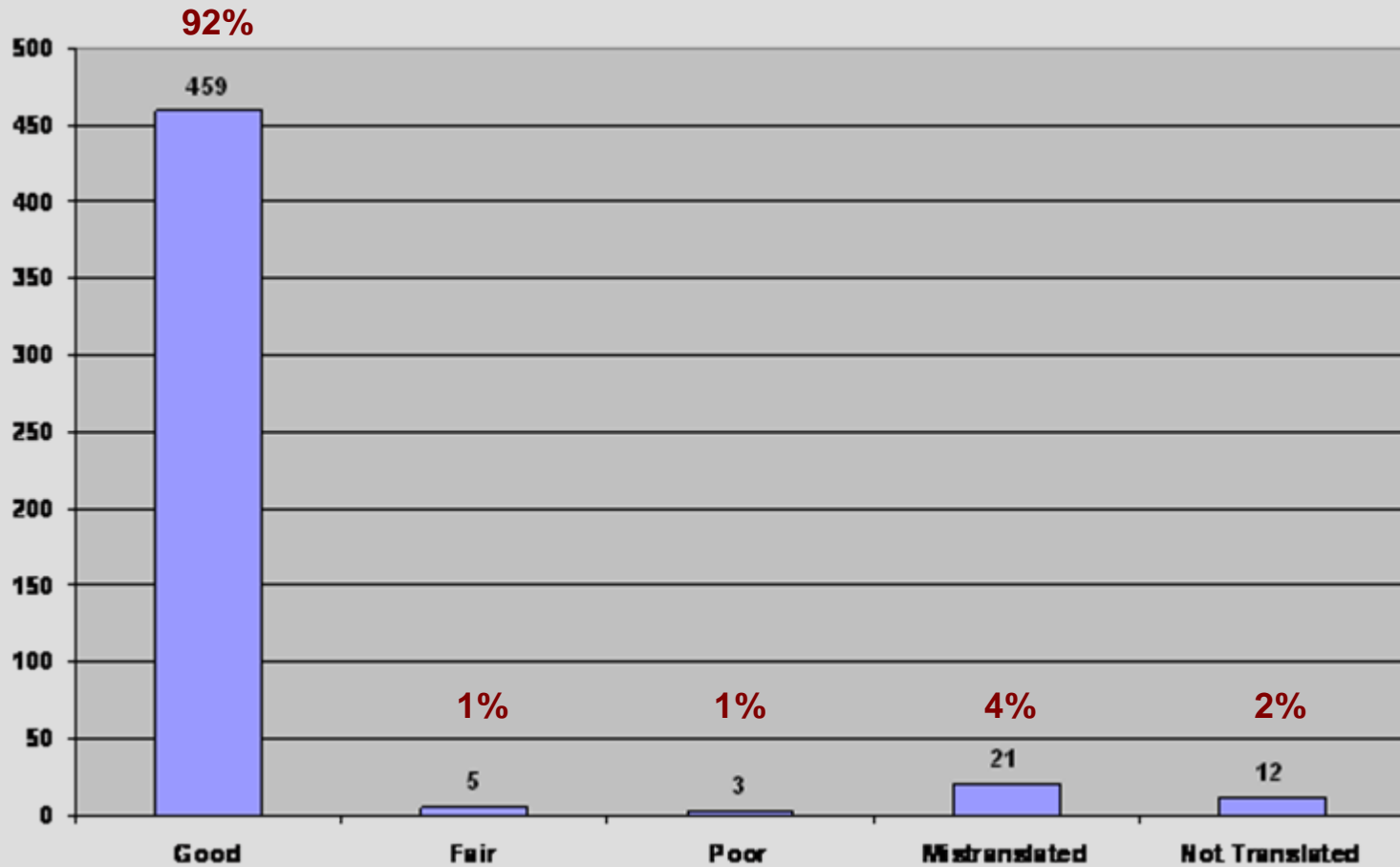
Nurse Scoring Examples

What Nurse Said	S-MINDS™ Translation	Human Translation	S-MINDS Accuracy
I will give you an I.V.	Voy a colocarle un cateter para liquidos intravenosos.	Voy a colocarle un cateter de liquidos intravenosos.	Good
Let me check if I can give you medication for that.	Dejeme chequear si puedo darle algun medicamento.	Permitame reviso si puedo darle algun medicamento para eso.	Fair
I will check your...	Yo voy a revisarle los vendajes	Voy a revisar su ...	Poor
Did someone take your vitals?	¿Le tomare sus signos vitales?	¿Alguien tomo sus signos vitales?	Mis-translated
Your heart rate is normal.	---	Su frecuencia cardiaca es normal.	Not Translated

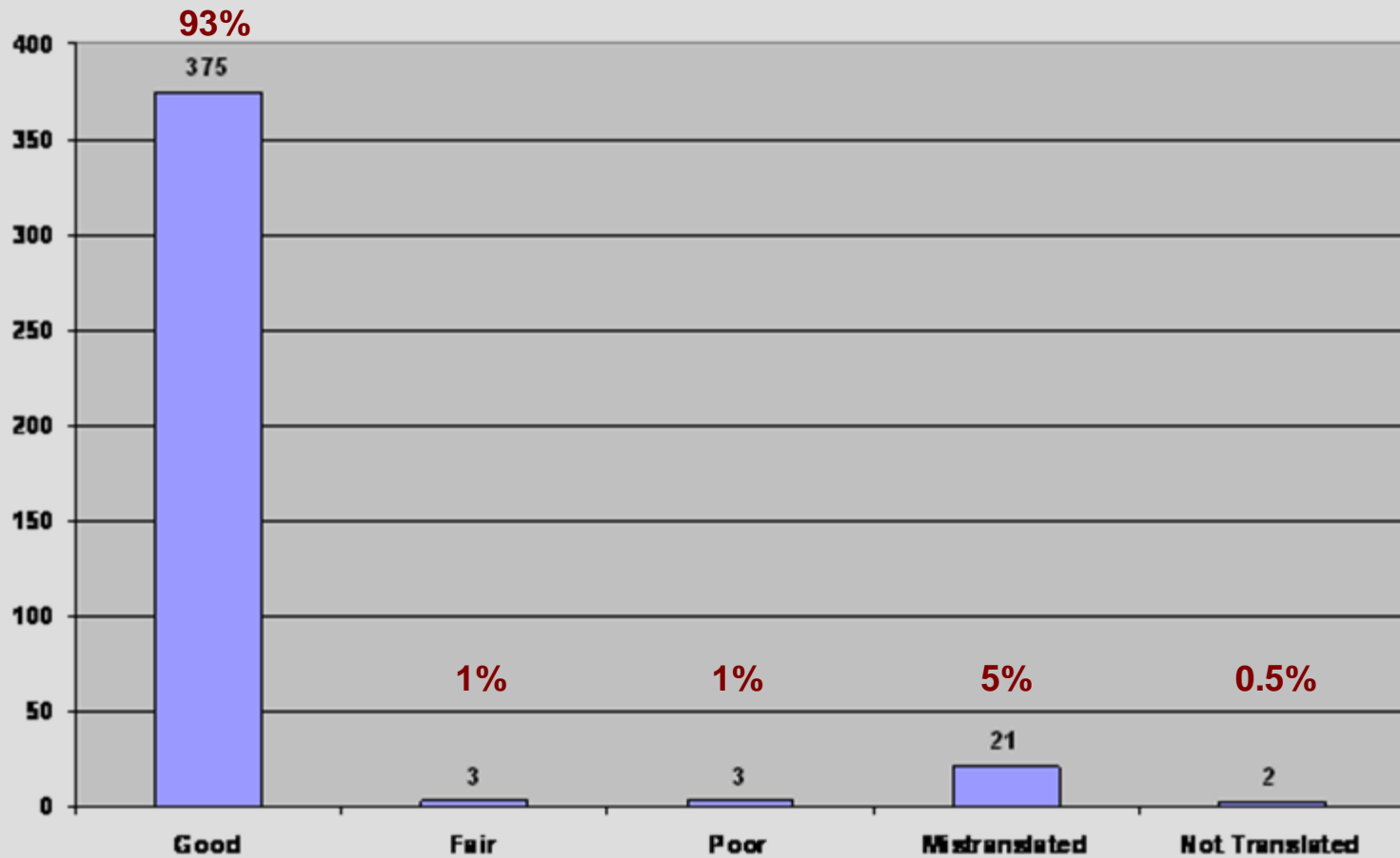
Patient Scoring Examples

What Patient Said	S-MINDS Translation	Human Translation	S-MINDS Accuracy
No, no tengo dificultad en respirar.	I don't have difficulty breathing.	No, I don't have difficulty breathing.	Good
En la parte baja del estómago.	The lower part of my stomach.	In the lower part of my stomach.	Fair
N/A	N/A	N/A	Mistranslated
Los huesos.	---	My bones	Not Translated

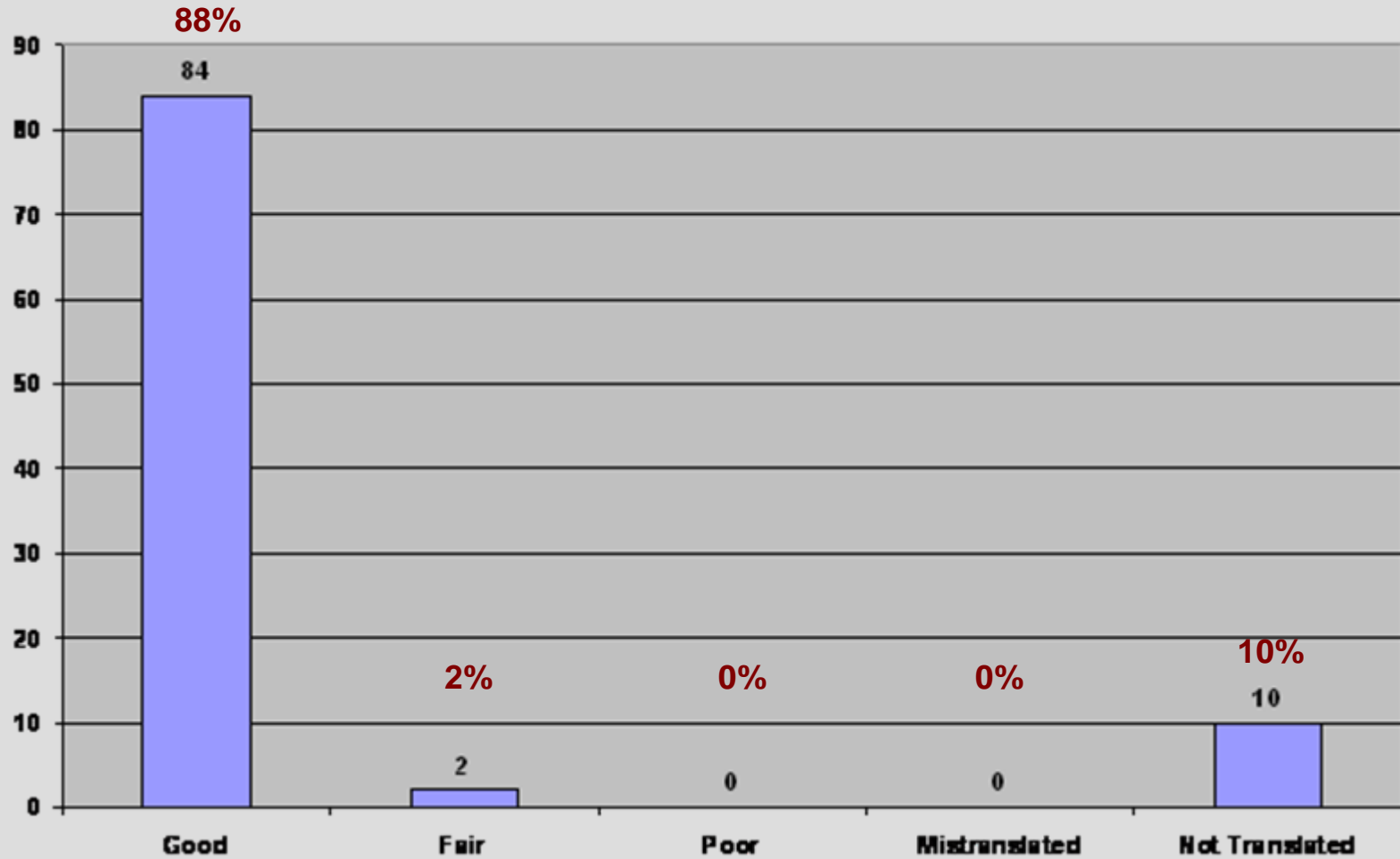
Overall Translation Accuracy



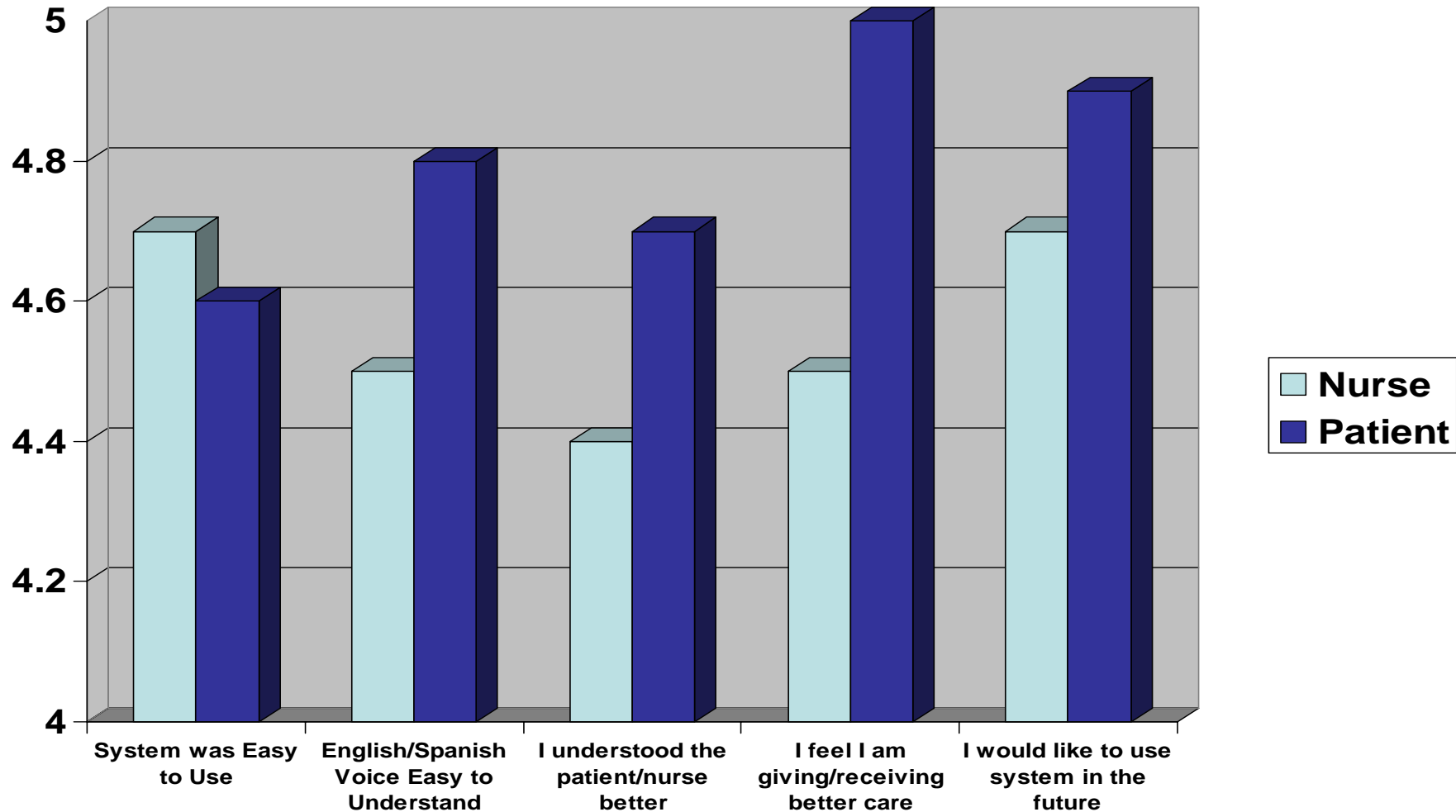
Nurse Translation Accuracy



Patient Translation Accuracy



Nurse/Patient Surveys (based on 5-point Likert scale)



Problems with Cloud-based Recognition

- **Startup time**
 - Up to 2 minute for bringing up a new processor
 - Need to have the processor before the user request
- **Real-time access**
 - Use of codecs decreases recognition accuracy
 - Bandwidth depends on network load
 - Even with good bandwidth the speed is variable

Future Effort

- **More extensive technology evaluation**
 - Low tolerance for errors in healthcare setting
 - Need to reduce user training time
- **Improve system performance with additional data**
- **Better system response**
 - To handle network load fluctuations

