

# It's Time Our Systems Talked Back



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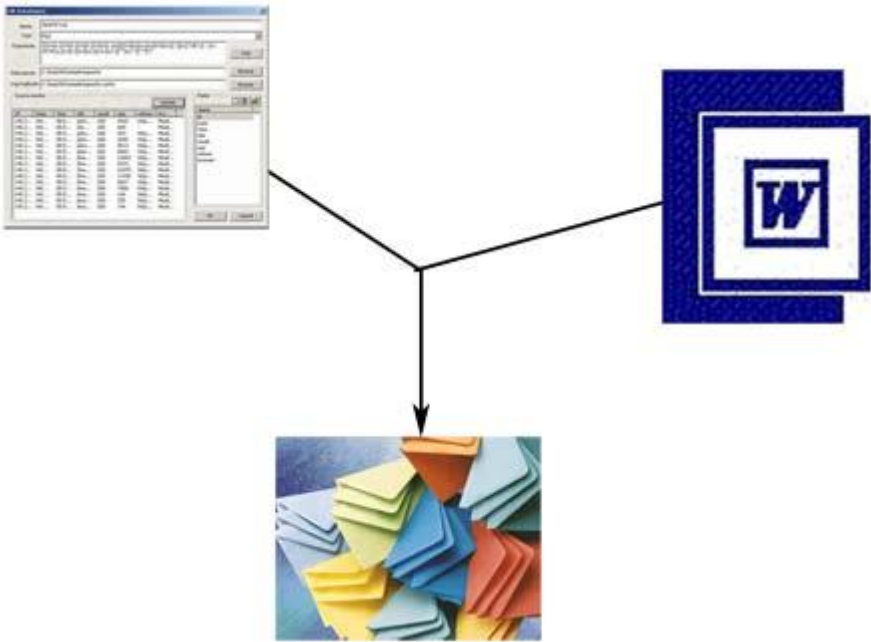
# NLG: The Missing Link

- Machine Translation helps people talk to people.
- Natural Language Understanding helps people talk to machines and systems.



- What's missing?
- We need to help machines and systems talk to people.
- That's what Natural Language Generation does.

# Automated Text Production in the 1980s



# Automated Text Production Today

## ANALYSIS & INTERPRETATION

## INFORMATION DELIVERY

DATA can be ingested from a wide variety of data sources, both structured and unstructured

RAW DATA

FACTS

MESSAGES

DOCUMENT PLAN

SENTENCE PLANS

SURFACE TEXT

NARRATIVE can be output in a variety of formats (HTML, PDF, Word...), combined with graphics as appropriate, or delivered as speech



DATA ANALYSIS processes the data to extract the key facts that it contains

DATA INTERPRETATION makes sense of the data, particularly from the point of view of what information can be communicated

DOCUMENT PLANNING takes the messages derived from the data and works out how to best structure the information they contain into a narrative

SURFACE REALISATION ensures that the meanings expressed in the sentences are conveyed using correct grammar, word choice, morphology and punctuation

MICROPLANNING works out how to package the information into sentences to maximize fluency and coherence

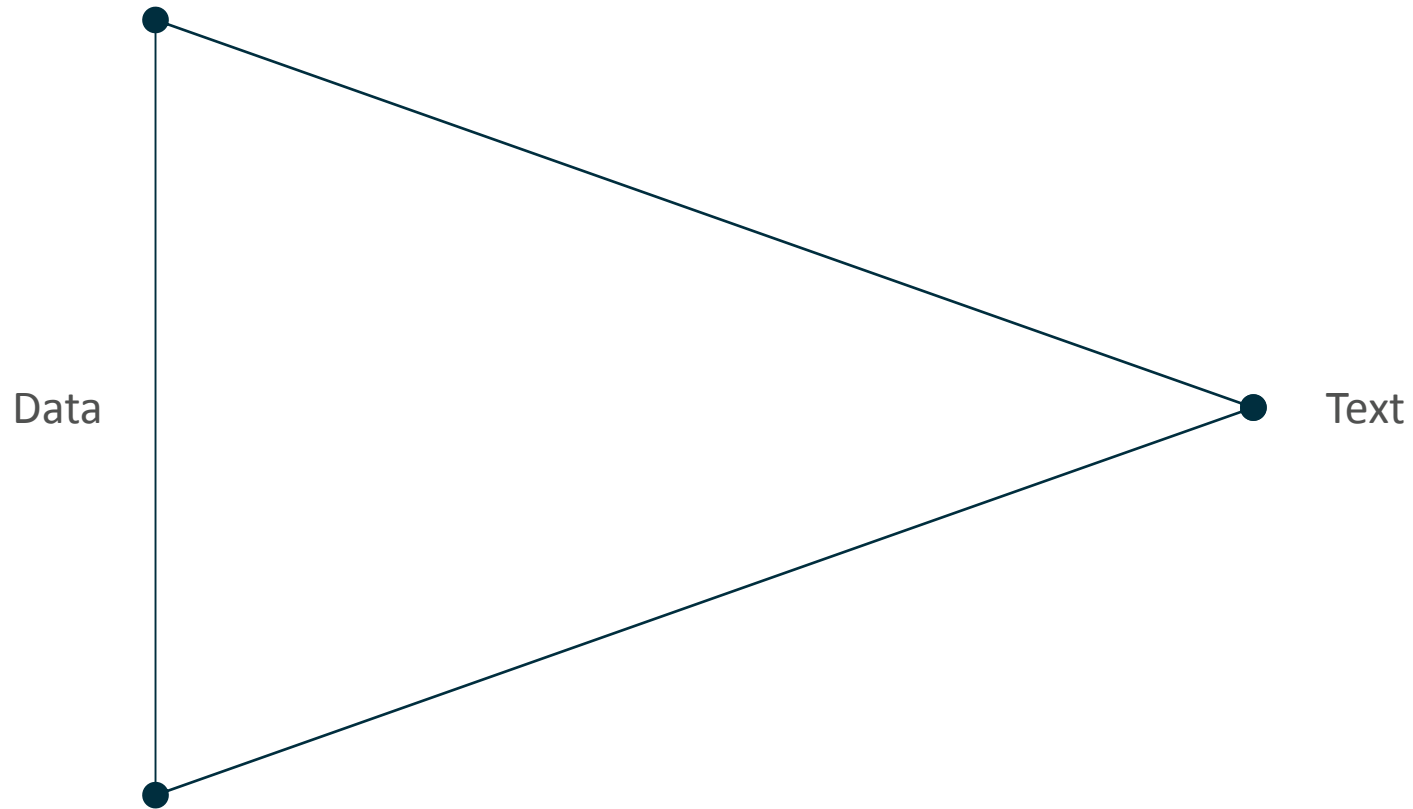
# The Distance Data Travels: 1980s

Data ●——● Text

# The Distance Data Travels Today



# The Depth of Data Today



# The Challenge:

## Delivering information from data in a way that people can use





CHARTS

graphs

numbers

Are you  
suffering from  
*dashboard*  
*fatigue?*

times gone by.

ORIGIN C16: from

**language** ● n. 1

either spoken or

in a structured

expression or

# Some examples of NLG in use

# NLG Brings Scalability

## BEFORE NLG

Prior to the use of NLG technology, the UK Met Office's staff would produce **60 weather reports a day**

## AFTER NLG

NLG technology, with no human intervention, can write **5,000 site-specific forecasts in a minute**

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00001, A' BHUIDHEANACH BHEAG,, SCOTLAND,
EUROPE,,1200,Fri,07,01,2011,0,NNW,15,13,1,VG,1021,40,27,10,1,3,N,11,9,0,VG,10,2,55,
18,6,1,6, WNW,9,6,0,VG,1022,61,13,3,1,9,WNW ,9,3,0, VG,1021,69,13,0,1,12, NW,9,1,0,
0, VG, 1021, 77,12,-3,1,15,NNW,7,-1,1,VG,1021,88,9,-5,1,18,NNW,8,5,1,VG, 1022,59,3,2,
1,21,NNW,7,10,1,VG,1020,43,16,9,1,24,N,8,12,1,VG,1019,40,14,10,1,27,WNW,6,6,0,VG,
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,1,45,E,3,VG,1020,48,10,9,1,48,WNW,1,11,3,VG,1019,44,6,11,1,51,WNW,4,8,2,VG,1020,6
9,6,7,1,54,WNW,4,7,7,VG,1020,84,5,6,1,57,NNW,4,6,9,VG,1019,90,5,5,1,60,N,3,6,9,GO,
1017,91,5,5,1,63,N,3,6,10,GO,1017,92,4,5,1,66,E,3,9,3,VG,1017,76,8,8,1,69,ESE,12,13,
3,VG,1014,46,23,10,1,72,SE,12,14,3,VG,1011,37,22,11,1,75,E,10,11,9,VG,1011,49,16,9,1,
78,E,6,10,9,VG,1011,75,9,8,1,81,E,6,9,9,VG,1011,78,8,8,1,84,E,3,8,9,VG,1011,90,3,7,1,87,
ENE,1,7,3,GO,1013,96,1013,96,2,7,1,90,WNW,4,11,3,VG,1016,71,13,11,1,93,NW,14,10,3
```

### Weather Forecast

**For 24 hrs. From 1800 on the 8th through to 1800 on the 9th.**

This evening and overnight: Rain with some heavier spells spreads north over parts of Western Isles to lay from the north to the southwest of the UK by dawn tomorrow, with a chance of snow over 300m in some areas of Northeast Scotland and Central Scotland towards the early hours.

Tomorrow: The rain band lying from the north to the southwest of the UK in the early morning will move north east off shore before dying out by late afternoon. Further rain with some heavier spells reaching the northwest of the UK towards midday will move east and reach the north and west of the UK by early evening. Another area of rain will develop in some areas of Southwest England and Southern England from late afternoon onwards.

**Faster, cheaper, more consistent.**

# NLG Brings Expertise Automation

O&G Engineering Maintenance Report: **3 hours of human effort replicated in 90 seconds**

## Situational analysis:

There was a Radial Bearing Temperature alert on Asset #1FGC1 GP at Nov 12 2012 13:08. The alert had been intermittently active since Nov 9 2012 22:44. An analyst had previously examined this alert during the intermittent period and did not turn it into a service. GP No. 2 & 3 Bearing Drain Temperature was stable at around 226 °F from Nov 12 2012 07:09 to 13:06, but the typical operating range is 140 °F to 220 °F. Bridge high setpoint was 220 °F when the alert triggered. FGC1 was on during this period.

Lube Oil Header Temperature and Tank Temperature were stable within the typical operating range.

## Summary since the alert was run:

GP No. 2 & 3 Bearing Drain Temperature was stable at around 224 °F from 13:13 to 19:04, but the typical operating range is 140 °F to 220 °F. Bridge high setpoint was 220 °F when the alert triggered. FGC1 was on during this period.

Lube Oil Header Temperature fell from 142 °F to 134 °F. Tank Temperature fell from 166 °F to 159 °F.

There was one closed service that had examined this alert: Service 8077 was closed on Aug 16 2012 12:37. An action was taken: 'Changed alarm high to 222 °F'.

## Recommendation:

There is likely to be a problem, which may be fixed by raising the set point.

Problem reasons: A long term rising trend was detected. However, the main tag went back to normal after the alert.

Action reasons: There are many active alerts.

The Radial Bearing Temperature alert was last modified on Apr 11 2011. Since then, the alert has been marked as 'No Action' 25 times. The alert was turned into a service 3 times.

## Summary over previous 90 days:

GP No. 2 & 3 Bearing Drain Temperature rose from 215 °F to 227 °F between Aug 14 2012 14:09 and Nov 12 2012 01:09. Bridge high setpoint is 220 °F. FGC1 was started 30 times during this period.

Lube Oil Header Temperature and Tank Temperature were stable within the typical operating range.

## Information:

The test tag was GP No. 2 & 3 Bearing Drain Temperature. The related tags were Lube Oil Header Temperature and Tank Temperature. The run tag was GP Speed.

## Data Sources

### Situational Analysis:

- Matrikon Alert
- Equipment Hierarchy
- Header Temperature Pi Tag
- Header Pressure Pi Tag
- Business Rules
- Tank Temperature Pi Tag
- Air Inlet Temperature Pi Tag
- Turbine Inlet Temperature Pi Tag
- Compressor Pressure Pi Tag
- Engine Speed Pi Tag

### Summary since alarm was run:

- Header Temperature Pi Tag
- Header Pressure Pi Tag
- Business Rules
- Air Inlet Temperature Pi Tag
- Turbine Inlet Temperature Pi Tag
- Compressor Pressure Pi Tag
- Fuel Gas Temperature
- Tank Temperature Pi Tag

### Recommendation:

- Business Rules

### Problem Reasons:

- Business Rules
- Alert History

### Summary over previous 90 days:

- Header Temperature Pi Tag
- Header Pressure Pi Tag
- Business Rules
- Air Inlet Temperature Pi Tag
- Turbine Inlet Temperature Pi Tag
- Tank Temperature Pi Tag
- Compressor Pressure Pi Tag
- Engine Speed Pi Tag

**Faster analysis, improved uptime.**

# NLG Brings Tailored Reporting

Same data sources. Different reports for different stakeholders



## DOCTOR REPORT

You saw the baby between 16:40 and 17:25. Heart Rate (HR) = 155. Core Temperature (T1) = 36.9. Peripheral Temperature (T2) = 36.6. Transcutaneous Oxygen (TcPO2) = 9.0. Transcutaneous CO2 (TcPCO2) = 7.4. Oxygen Saturation (SaO2)=94.

Over the next 24 minutes there were a number of successive desaturations down to 0. Fraction of Inspired Oxygen (FIO2) was raised to 100%. There were 3 successive bradycardias down to 69. Neopuff ventilation was given to the baby a number of times. The baby was re-intubated successfully. The baby was resuscitated. The baby had bruised skin.

Blood gas results received at 16:45 showed that PH = 7.3, PO2 = 5, PCO2 = 6.9 and BE = -0.7. At 17:15 FIO2 was lowered to 33%. TcPO2 had rapidly decreased to 8.8. Previously T1 had rapidly increased to 35.0.

SOURCE: NEONATAL ICU, UK



## NURSE REPORT

**Current Status:** Currently, the baby is on CMV in 35% O2. Vent RR is 50 breaths per minute. Pressures are 25/4 cms H2O. Tidal volume is 5.7. SaO2 is variable within the acceptable range and there have been some desaturations down to 38. The most recent blood gas was taken at about 04:00. There is fully compensated respiratory acidosis or secondary compensation of metabolic acidosis. pH is 7.23. CO2 is 10.4 kPa. BE is 4.2 mmol/L. The last ET suction was done at 07:00. There were large amounts of mucoid secretions. Oral suction was done. There were large amounts of mucoid secretions. Currently, he is being given 0.64 mls/hr of morphine via continuous infusion. He is on CPAP in 35% O2.

**Events During the Shift:** The baby was intubated at around 06:45 and was on CMV. Vent RR is 50 breaths per minute. Pressures are 25/4 cms H2O. Tidal volume is 5.7. FIO2 was lowered to 35%. Since around 07:45, he has been on 0.64 mls/hr of morphine via continuous infusion.

SOURCE: NEONATAL ICU, UK



## FAMILY REPORT

Your baby, John, is receiving intensive care at the Royal Infirmary of Edinburgh. He is being looked after in Blackford nursery in cot space five.

John is now 2 days old with a corrected gestation of 24 weeks and 2 days.

His last recorded weight is 460 grams (1 lb 2 oz). Because John was born earlier than expected, he has been nursed in an incubator. This keeps him warm by keeping the heat and humidity in the incubator and preventing him from losing too much moisture from his fine skin.

John is currently receiving ventilation support. Ventilation helps to provide the support that enables him to breathe more easily. It does this by giving extra breaths, pressure and/or oxygen to baby's lungs. So that your baby's lungs remain open for oxygenation. In the morning, the amount of oxygen required for your baby was around 27%. In the last 12-hours this has been between a high of 50% and as low as 27%.

Baby John has been administered the drugs Morphine (Analgesic) and Suxamethonium.

The right information to the right people at the right time.



Your Data

Your User

# How NLG Bridges the Gap





# NLG: The future for information delivery

# Five Predictions

1. In a world of data overload, ability to communicate will separate the winners from the losers
2. The market will segment into cheap robo-writing vs precision NLG
3. Enterprises will adopt multilingual NLG ecosystems to deliver their reporting needs
4. NLG as a category will disappear: it's all about MID – Multilingual Information Delivery
5. By 2020, there will be more texts written by machines than by humans



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NATURAL LANGUAGE GENERATION

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