



# The twilight zone'

Anders Kallner

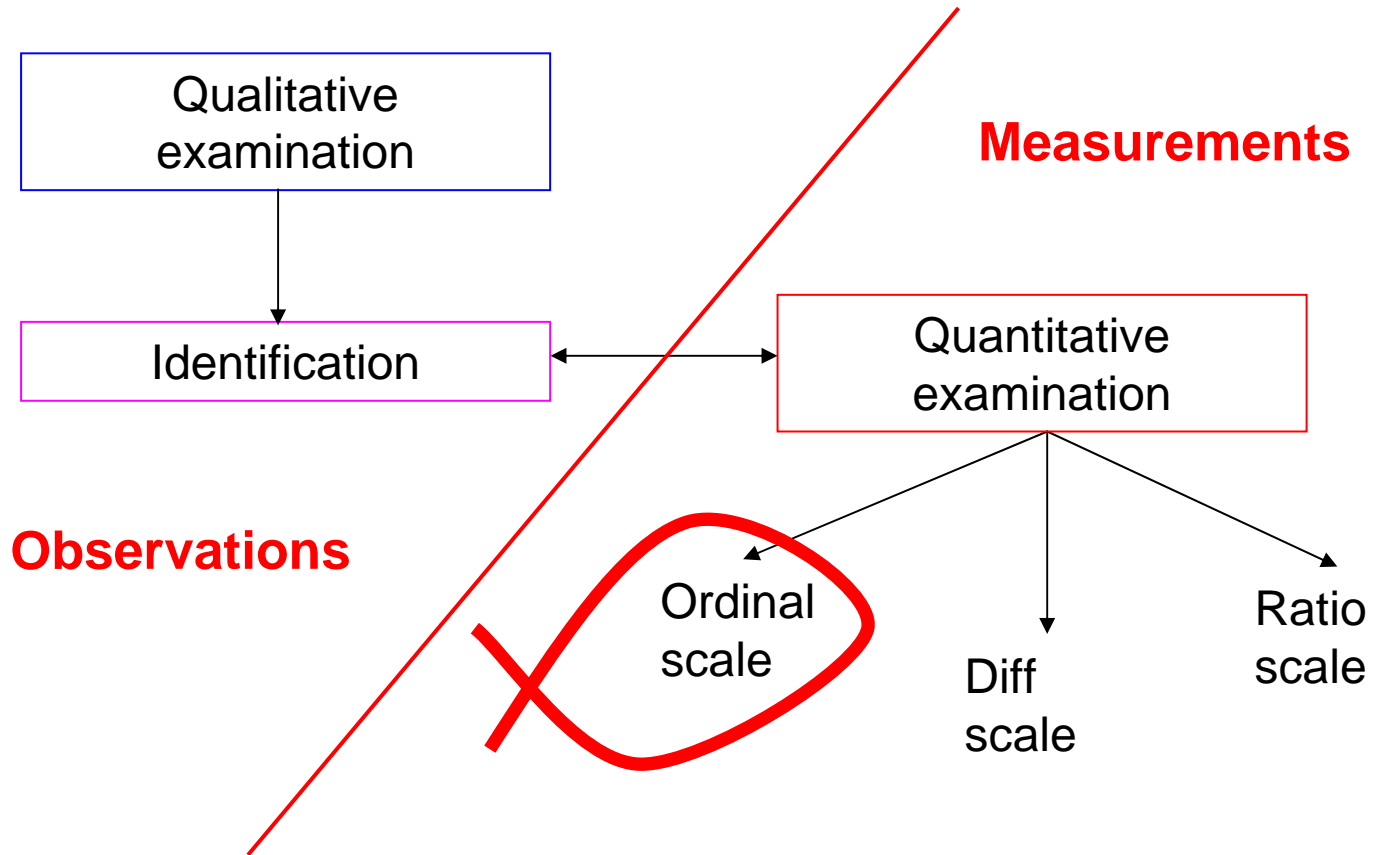
Dept Clinical Chemistry

Karolinska University Hospital

Stockholm, Sweden



# Examination sequence





# Nominal scale

- Only examinations that result in an identification are reported on a nominal scale – and truly qualitative

## Examples:

**Blood groups, cell identification, gender**



**Decision-makers in government and industry increasingly need simple yes or no answers from analytical chemists. Complicated numbers, sets of data, or ranges of values from the laboratory are often difficult to make sense of, offering no obvious and immediate solutions to political and societal problems.**

*(MEQULAN: “Metrology of Qualitative Chemical Analysis” EU G6MA-CT2000-01012)*

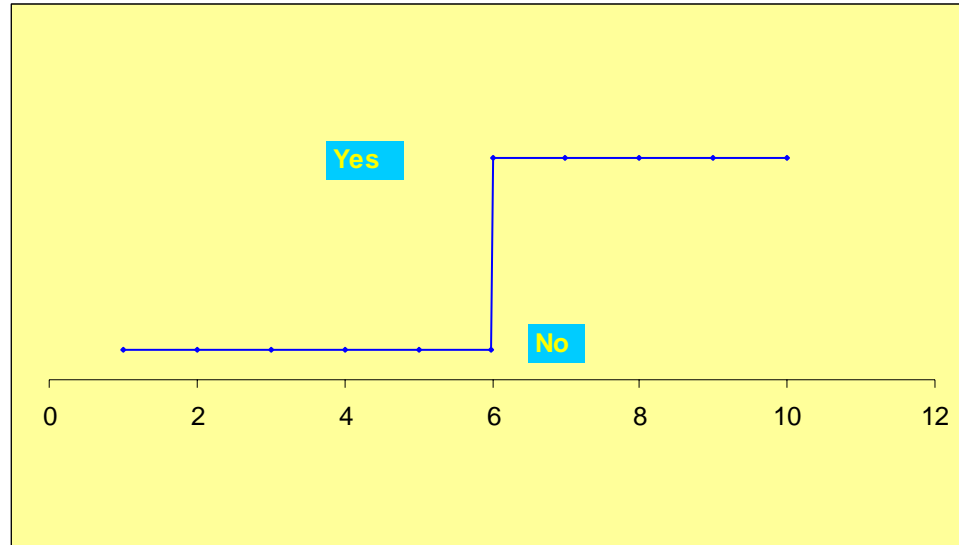


# Binary results

Binary results classify properties as  
'yes' or 'no' or (+) and (-)



# Binary response





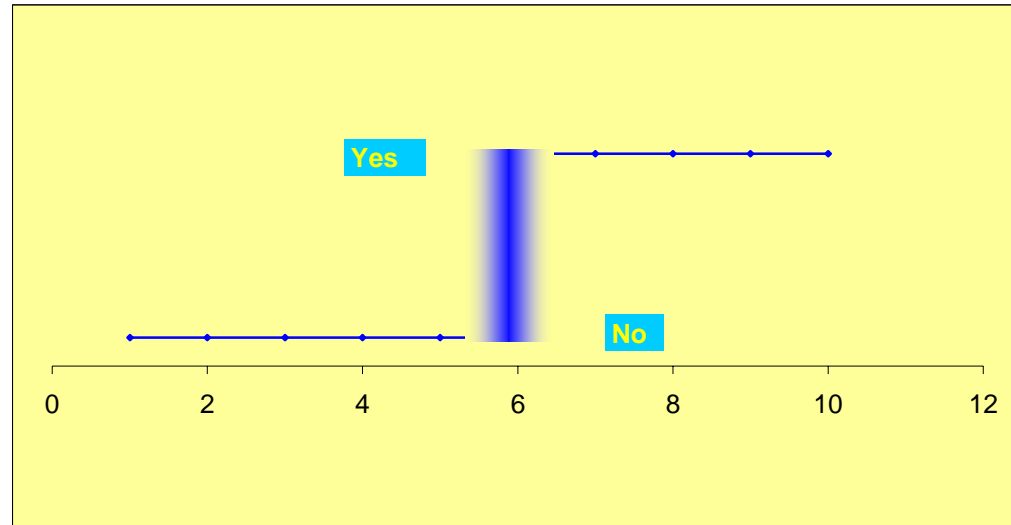
# Binary measurements

- Pregnancy tests
- HIV
- Hepatitis



**But it is no easy task for the lab to give a yes/no response. This is because the most interesting data are often revealed near the limits of our ability to measure. We are obliged therefore to operate in areas of significant uncertainty. We just don't know for sure if it's yes or no.**

*(MEQULAN)*





# Binary results

Binary results classify properties as 'yes' or 'no' or (+) and (-).

Are examinations with a binary outcome qualitative or quantitative?



# Semiquantitative measurement procedures

Synonym to 'Inferior quality'?

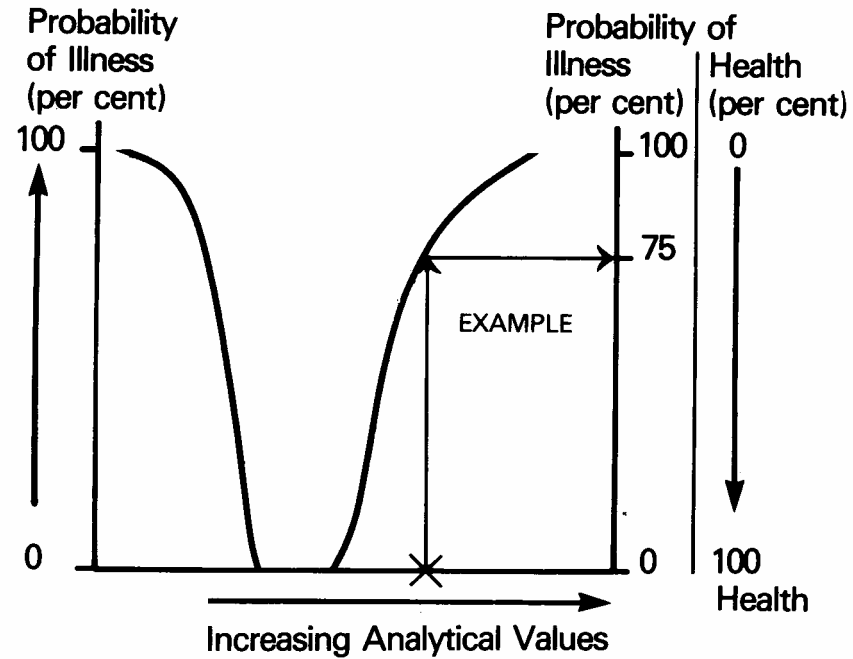
Modern procedures that used to be called semiquantitative are no longer inferior

Preferred name is 'reported on the ordinal scale'



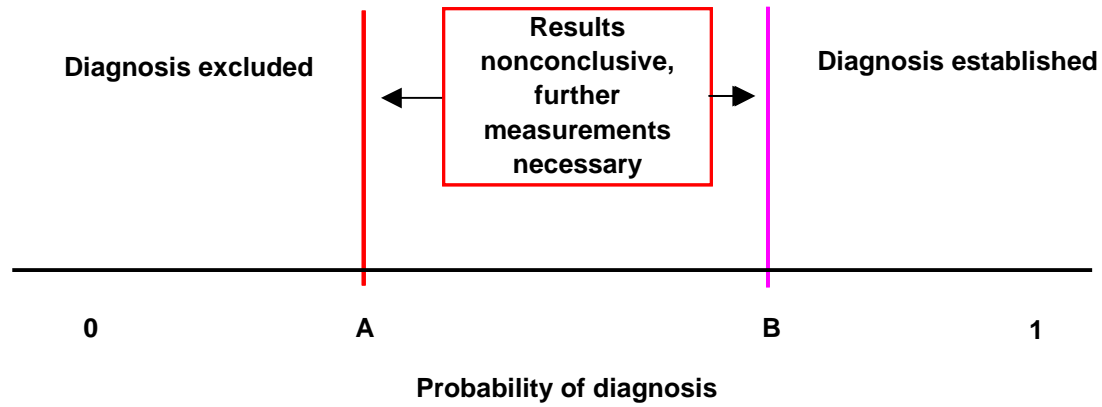
Courtesy Drs G & I Jungner

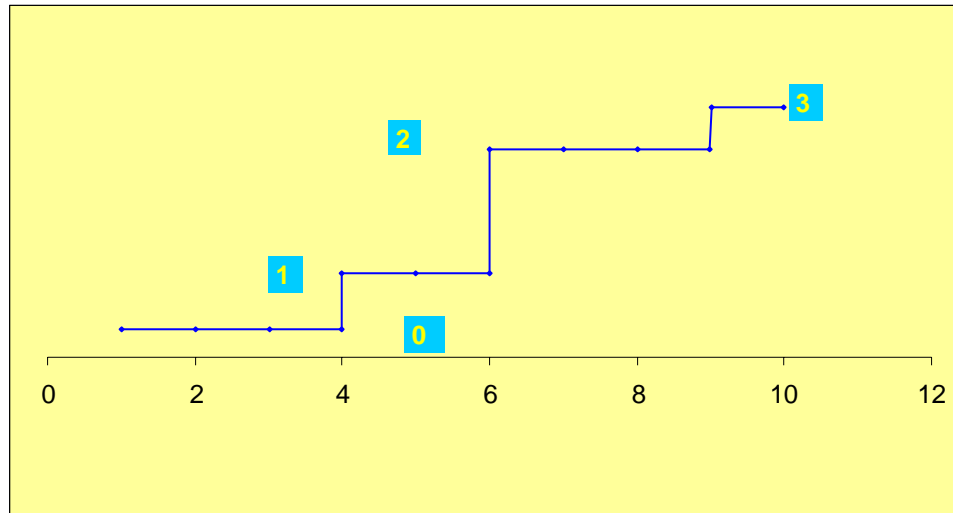
## ILLNESS LIKELIHOOD CURVE ("IL")

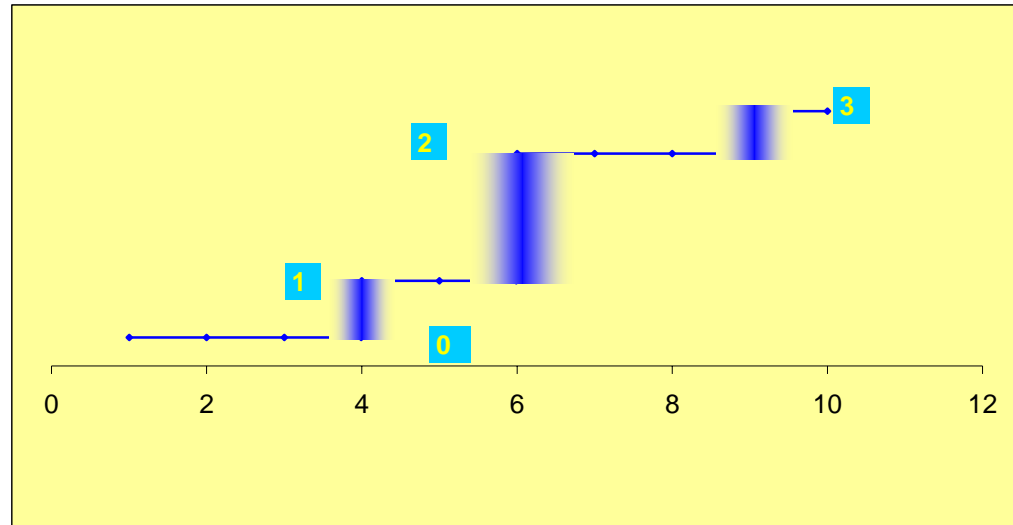


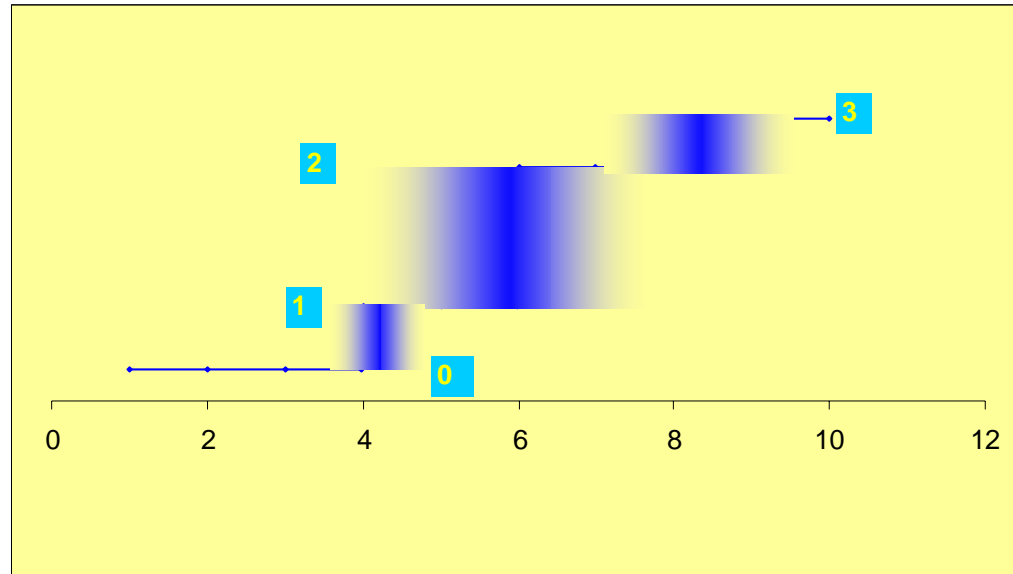


## One-sided situation











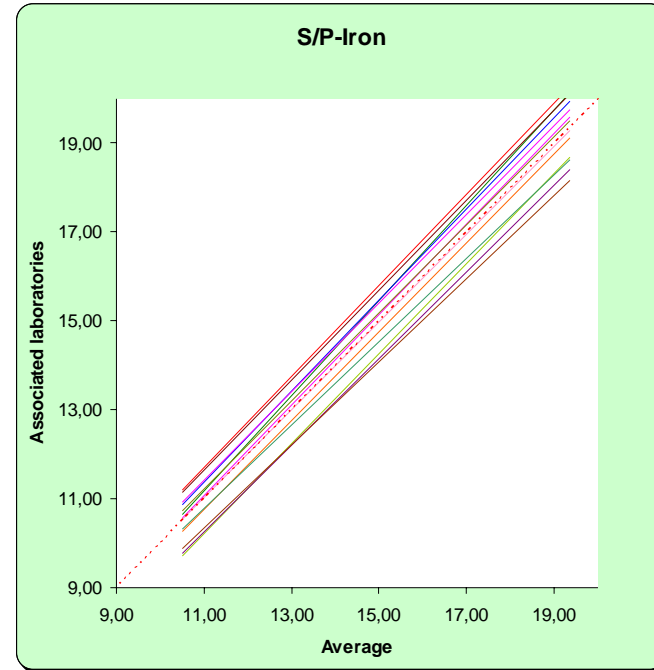
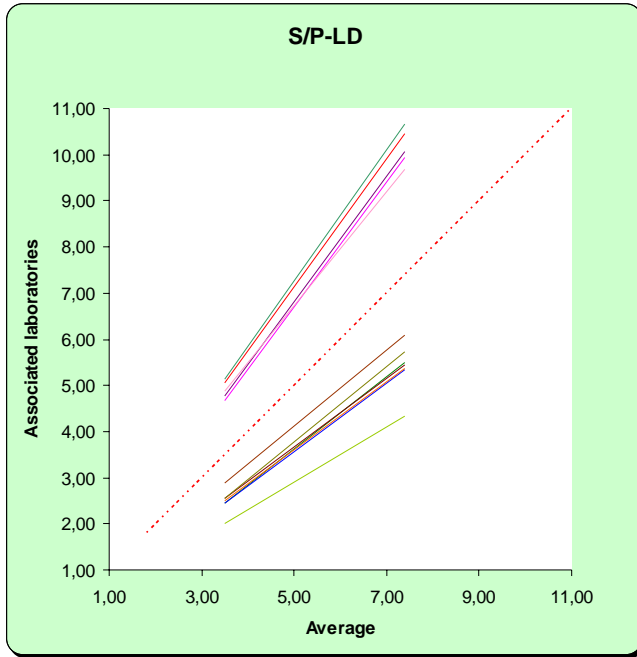
# Identification of the component

Different procedures are used to measure the same component

Results must be comparable

Requires harmonisation of results

1. Demonstrate proportionality between results
2. Establish reliable regression functions
3. Recalibrate
4. Traceability issues?
5. Information in designation?



S/P-LD - High								
	df	Sum sq	MS	F	F-crit p=0,05	p-value	MAX	MIN
Between	11	411,92	37,447	7792,98	1,952	0,000	10,72	4,33
Within	60	0,29	0,005	<b>Significant difference between laboratories</b>				
Total	71	412,21						
Mean:	7,38	Within SD	0,069	Betw SD	2,498	Tot SD	2,499	
r2:	0,999	Within CV%	0,9	Betw CV%	33,8	Tot CV%	33,8	
Adj r2:	0,999							

S/P-LD - Low								
	df	Sum sq	MS	F	F-crit p=0,05	p-value	MAX	MIN
Between	11	105,4843	9,589	549,70	1,952	0,000	5,60	1,97
Within	60	1,04670	0,017	<b>Significant difference between laboratories</b>				
Total	71	106,5310						
Mean:	3,49	Within SD	0,132	Betw SD	1,263	Tot SD	1,270	
r2:	0,9902	Within CV%	3,8	Betw CV%	36,2	Tot CV%	36,4	
Adj r2:	0,9884							

S/P-Iron - High								
	df	Sum sq	MS	F	F-crit p=0,05	p-value	MAX	MIN
Between	12	36,04	3,004	24,88	1,904	0,000	21,43	16,80
Within	65	7,85	0,121	<b>Significant difference between laboratories</b>				
Total	77	43,89						
Mean:	19,36	Within SD	0,347	Betw SD	0,693	Tot SD	0,775	
r2:	0,821	Within CV%	1,8	Betw CV%	3,6	Tot CV%	4,0	
Adj r2:	0,788							

S/P-Iron - Low								
	df	Sum sq	MS	F	F-crit p=0,05	p-value	MAX	MIN
Between	12	17,4211	1,452	136,17	1,904	0,000	11,40	9,60
Within	65	0,69298	0,011	<b>Significant difference between laboratories</b>				
Total	77	18,1141						
Mean:	10,50	Within SD	0,103	Betw SD	0,490	Tot SD	0,501	
r2:	0,9617	Within CV%	1,0	Betw CV%	4,7	Tot CV%	4,8	
Adj r2:	0,9547							



# Diagnostic performance

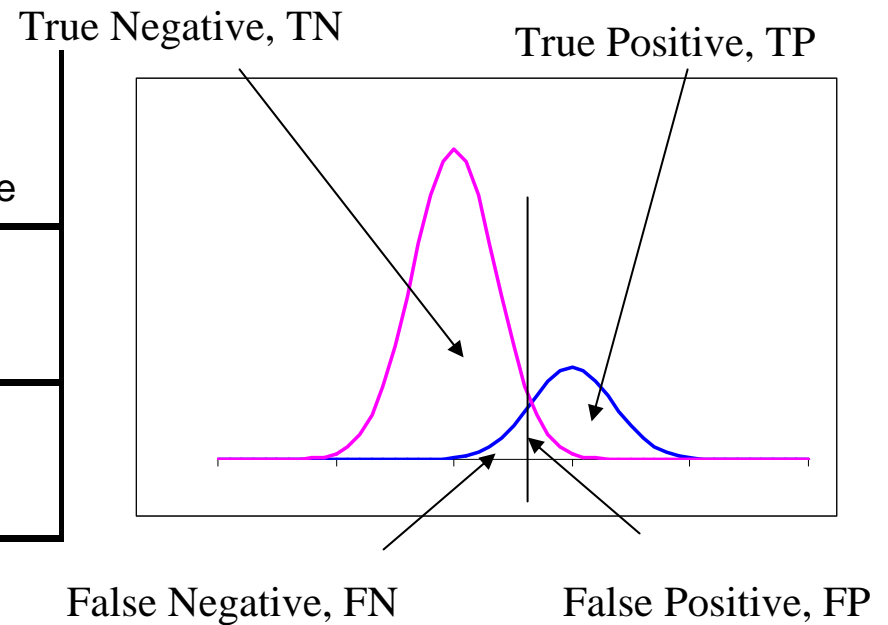
Diagnostic performance is *to limit false results*

False negatives: diseased misclassified

False positives: non-diseased misclassified



		Test outcome	
		Positive	Negative
STATUS	Healthy	FP	TN
	Non-healthy	TP	FN



$$\textit{Specificity} = \frac{TN}{TN + FP}; \quad \textit{Sensitivity} = \frac{TP}{TP + FN}$$

$$PV(+)=\frac{TP}{TP + FP}; \quad PV(-)=\frac{TN}{TN + FN}$$



# Measurement specifications

The detectability and the cut-off concentrations determine the diagnostic sensitivity and specificity of the measurement procedure

It is crucial for the laboratory to monitor the performance and the physician to consider its impact on patient care

A scenic view of a red wooden house with white trim, situated on a rocky coastline. The house is surrounded by trees, including evergreens and bare deciduous trees. In the foreground, there is a large, grey, rocky outcrop. The water is calm and greyish-blue. In the distance, another small red house is visible on a hill. The sky is overcast and grey. A white bird is flying in the sky. The text "Thank you!" is overlaid in blue on the right side of the image.

**Thank you!**