The Sciences of the artificial :- *) Opposite to Natural science
*) Artificial → It includes 'Artifacts' are ~~made by~~ objects & phenomena which are made by man
*) Aim:- Attaining specific goals through interfacing between the outer & inner environment of Artifact

Inner & outer Artifacts (environment) :-

*) Inner environment:- Character, substance, composition & structure of the Artifact (It is what it is made of)
*) Outer environment:- situation, context & physical space the artifact exists in.
*) An Artifact is an interface b/w these two environments.
"It solves a problem that exists in the outer environment by adapting to it's inner environment."

Example
*) Artifact is a sundial → it's inner environment is a clock casting shadow, it's outer environment is a sunny climate Goal is to keeping time.

Natural side of IT research :-
→ we observe what is happening, we describe
→ ~~we describe~~ the core activities are those of discovery, theorizing & justification
→ Results are evaluated through truth & explanatory power.
→ The progress is made through better understanding, more accurate explanations, stronger predictive power.

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Example: By studying the principles behind an existing IT systems architecture & creating a theoretical framework of its behaviour, we are able to explain, predict & corrects its behaviours in the future.

The Artificial side of the IT Research

⇒ Can be characterized by the following points:-

⇒ We create artifacts for a specific purpose, we prescribe

⇒ The core activities are those of building, designing, & evaluating.

⇒ We will evaluate our results on how well our artifacts perform against value & utility, does the artifact really work does the solution produce an improvement

⇒ We make progress by replacing outdated & poorly constructed solutions with better and more efficient ones

Example:- Smaller, lighter and faster computers, more efficient development methods: agile vs. waterfall

Natural vs. Artificial side of research: Summary

	Natural	Artificial
Character	description	Prescription
Core activities	discovery/theorizing, justification	building/designing, evaluating
Results are evaluated against	Truth, explanatory Power	value, utility
Progress is made through	Better understanding, more accurate explanations, predictive power	Replacing outdated (or) Poorly constructed solutions with better/efficient ones

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Summarizing Design & Science

Designers:- They stress relevance, they want to solve real problems in real-world & produce useful and practical results that can be accepted by stakeholders

Scientists:- They stress rigour they want to build more knowledge wants to ensure validity and reliability by using established research methods & they want to relate the results to theories

Designerly ways of thinking are not scientific:

Design:- Intuitive, subjective, practical (ex- Eiffel Tower)
Science:- methodical, objective, theoretical (ex $E = mc^2$ — energy, mass, speed of light)

→ Where does knowledge come from? *) learning a particular fact *) learning a general law (*) learning from others

→ But is it only experience? No, we have to take the reflections as well. ex:- If a weigh machine shows that you are 66kgs the reflection must be "Is the scale is functioning correctly". If cold cause fatigue, you take from previous experience If something is posted on Newspaper, you conclude it is reliable by the credibility of the Newspaper.

Cognitive Biases:

*) Anchoring Bias:- We humans usually completely rely on the first information that we received

*) Availability Bias:- People overestimate the information that they have

*) Conformation Bias:- We tend to listen information that confirms what we already know. (or) even interpret the information that we receive in a way that the current information that we already ~~know~~ have.

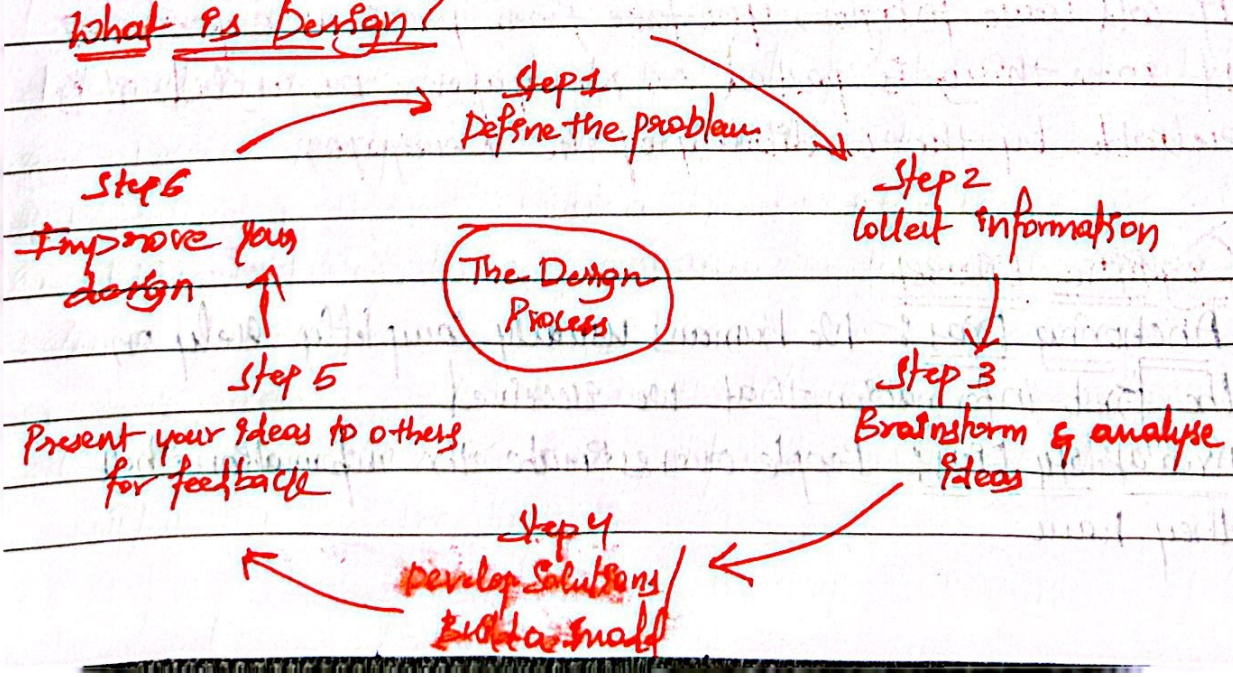
*) Ostrich Bias:- This is the decision (or) rather subconscious ~~design~~ decision to ignore the negative information. only considering the positive aspects.

*) Outcome bias:- we tend to judge the efficacy of a decision based primarily on how things turn out & after decisions is made we rarely examine the conditions that existed at the time of decision choosing instead evaluate performance choosing instead to evaluate performance solely (or) mostly on whether the end results were positive (or) not.

*) Survivorship Bias:- Judging something based on surviving information.

*) Blind Spot Bias:- we are bias because we think we are less bias; Bias because everyone else are less biased.

What is Design?



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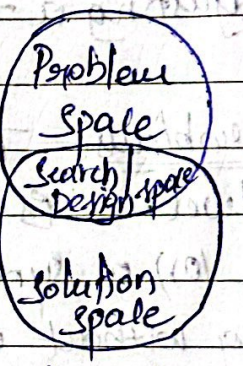
The Design Research Process:-

Three Basic Activities:- i) Analyze problem (ii) Design solution (iii) Evaluate Solution.

Framework for Design Research:-

i) Explicate problem (ii) Define Requirements (iii) Design & develop artifact (iv) Demonstrate Artifact (v) Evaluate Artifact

Problem Space, Solution Space, Search Space well & ill-structured problems



*) Problem space:- the way from becoming aware of a problem to explicating & defining that problem in detail to starting to think of a possible solution.

*) Solution space:- One might consider suitable for addressing the defined problems to yield an improvement under the specified constraints

*) Search space:- is all available strategies that a problem solver employs when searching for a solution.

*) A lot is known about the problem/context, 'known knowns': well-structured problems.

*) A lot is unknown, 'known unknowns': ill-structured

*) Uncertain, 'unknown unknowns': wicked problems.

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Well-structured problems:- Are simple to address. Another name is tame problems we can set clear goals & work from problem towards solution in clear way.
Ex:- Converting celsius to Fahrenheit

Ill-structured problems:- Difficult to specify what problem is about and also the needs to be addressed. We might know certain things but not everything. Breaking the problem down into smaller sub problems, establishing sub goals and use means ends analysis
Ex:- Adjusting a tax rate, creating a new business

Wicked problems:- Taking the ill-structured problems to extreme level. It is unknown whether the problem is original (or) a symptom of another problem. One might designing without a precise goal in mind but rather a change of direction
Ex:- Societal problems, dilemmas

Decision Making in DCR:-
Rational choice *) Formalized methods for choosing b/w alternatives
Ex:- Decision theory, rational choice theory.
*) Formalized methods for finding the optimum course of actions.
Ex:- Minimax rule, linear programming, dynamic programming, control theory.

→ (design methodologies)
Practical Reasoning:- Choosing b/w design methodologies: suitability for the task & goal
Eg:- Difficult to obtain information directly → "design a cycle" by Eekels & Roozenburg (1991)

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* Practical reasoning (design alternatives)

Design support for choosing b/w design alternatives:-
- Specifying requirements, or the criteria for assessment
- Means/ends analysis based on the desired end goals or the solution state.

Means & End Analysis:- Focuses on goals and serves to shorten the gap b/w problem state & the desired solution state.

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