Fall 1999

Introduction to Industrial Engineering: Interpretation of Visual Displays

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IE 150

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Class Exercise 7: Interpretation of Visual Displays

OBJECTIVE

The area of ***human factors*** or ***ergonomics*** focuses on human beings and their interaction with products, equipment, facilities, producers, and environments used in work and everyday life. The emphasis is on human beings and how the design of things influences people.

One small area of ergonomics is concerned with how humans interpret visual displays. For an introduction to this area, let's consider the visual interpretation of static displays (*i.e.*, information that is not changing).

INSTRUCTIONS

[1] Each of the three figures in this exercise, Figures 1, 2, and 3, is made up of 100 symbols. Each figure is composed of one class of symbols (military symbols, geometric forms, and aircraft shapes).
[2] Your task is to count the number of a specific type of symbol in each figure.
[3] For each count, work as quickly and accurately as possible.
[4] DO NOT MAKE ANY MARKS ON THE FIGURES WHILE COUNTING.
[5] Record your count

	Your Count	Correct or Incorrect
Figure 1. Military symbols:		
1. Gun 	_____	_____
2. Missile 	_____	_____
3. Radar 	_____	_____
4. Ship 	_____	_____
Figure 2. Geometric forms:		
1. Triangle 	_____	_____
2. Semicircle 	_____	_____
3. Star 	_____	_____
4. Diamond 	_____	_____
Figure 3. Aircraft shapes:		
1. F-100 	_____	_____
2. C-54 	_____	_____
3. B-52 	_____	_____
4. C-47 	_____	_____

Figure 1: Military Symbols

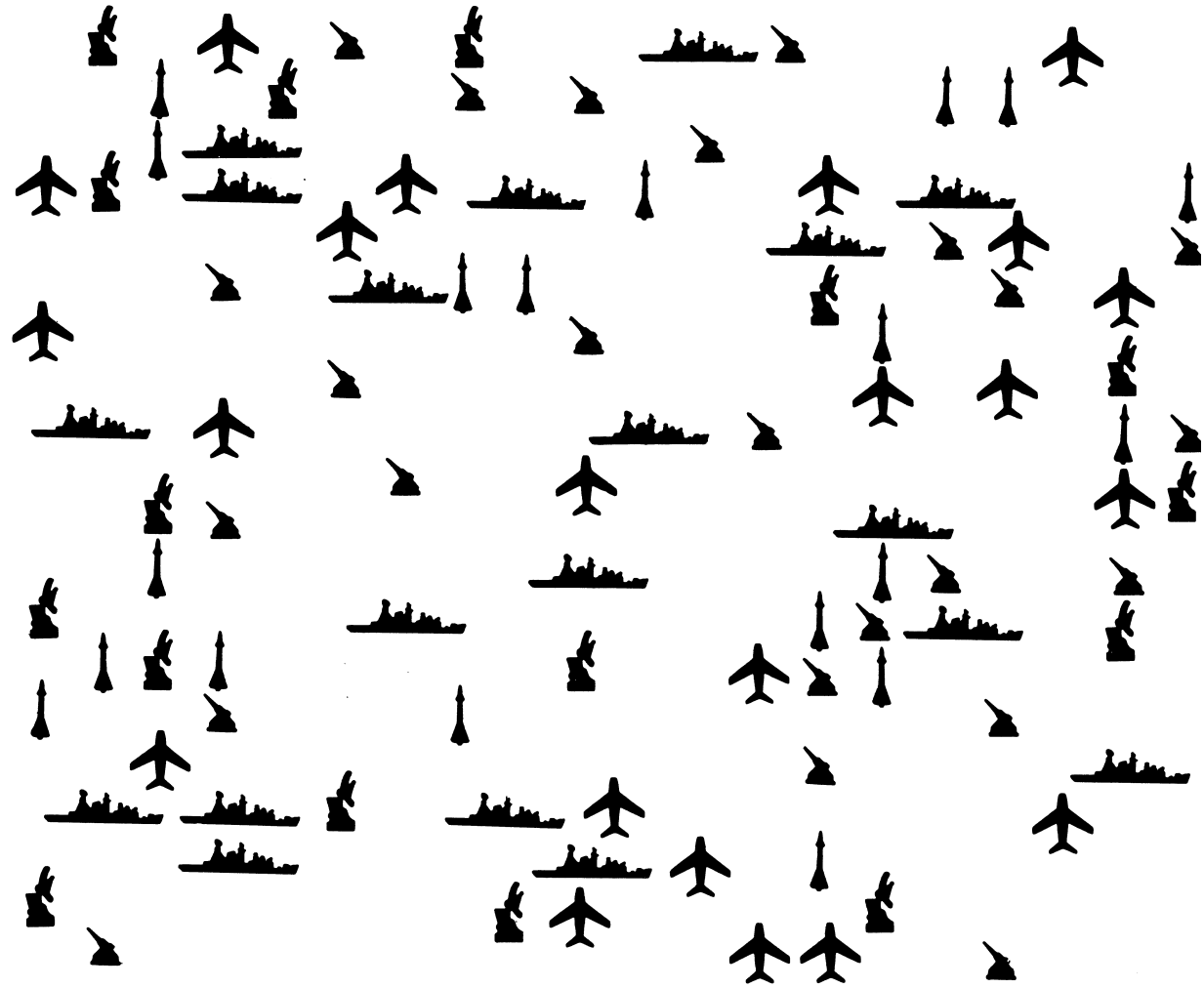


Figure 2: Geometric Forms

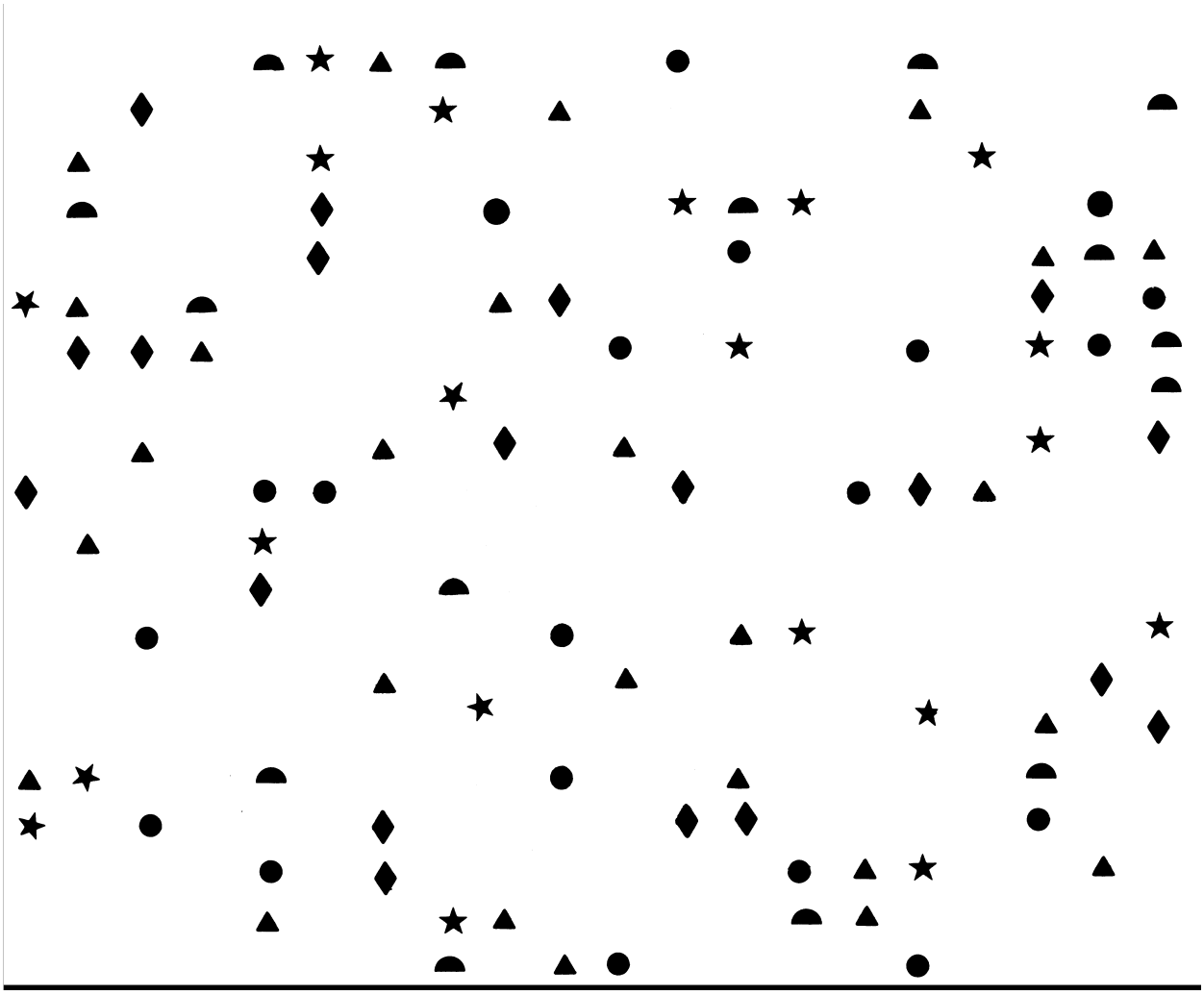
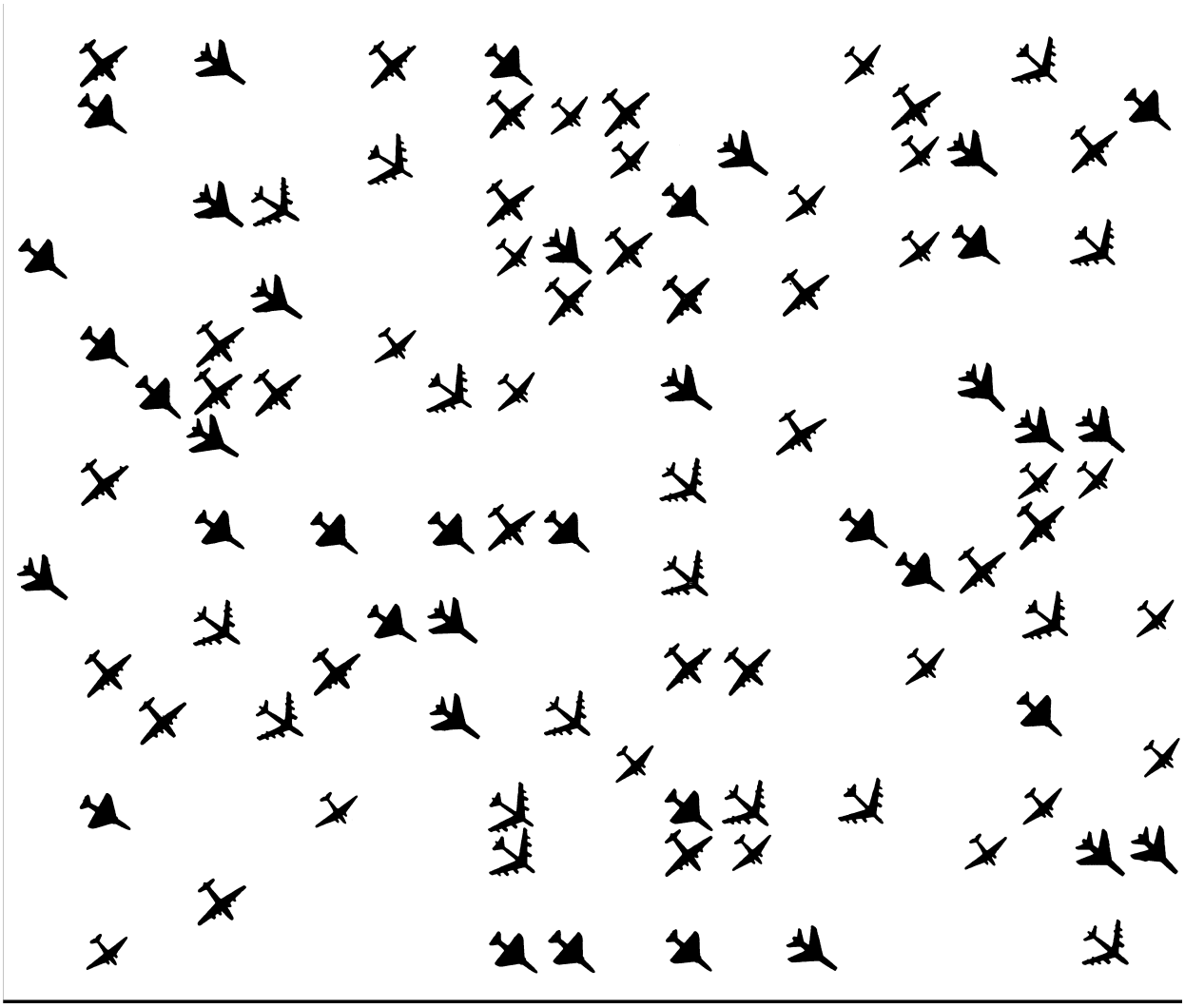


Figure 3: Aircraft Shapes



CONCLUSION

In everyday life, we are bombarded with numerous visual displays such as newspapers, magazines, billboards, road signs, instructions, warning signs, maps, graphs, labels, directions, etc. Properly designed graphics (*e.g.*, road signs) can easily present information. Improperly designed graphics only causes confusion.

THINK ABOUT QUALITY INSPECTION

Influencing Factors

The three cognitive components of inspection are search, detect, and assign status. Effective searching requires attention, perception, and memory. Detecting a flaw requires skill in detection, recognition, and memory. Once a flaw is detected, the item is accepted or rejected using judgement, classification, and memory. These cognitive components can be affected by many factors including time on task, distractions, social conditions, sleep deprivation, defect frequency, and motivation. The below table lists other factors that influence inspection performance:

Factors that may Influence Inspection Performance

Individual Factors	Physical and Environmental Factors	Task Factors	Organizational Factors
Visual acuity	Lighting	Inspection time	Number of inspectors*
Static*	General*	Stationary*	Briefing/instructions
Dynamic	Surround luminance	Conveyor-paced*	Feedback*
Peripheral	Lighting for color	Paced versus unpaced	Feed forward*
Color vision*	Specialized*	Direction of movement	Training*
Eye movement scanning	Aids	Viewing area	Selection*
strategies*	Magnification*	Shape of viewing area	Standards*
Age*	Overlays*	Density of items*	Time on task*
Experience*	Viewing screen*	Spatial distribution of	Rest pauses
Personality	Closed-circuit TV	items	Shift*
Sex	Partitioning of display	Defect probability*	Sleep deprivation
Intelligence	Automatic scanner	Defect mix	Social factors
Subjective probability of	Background noise	Defect conspicuity*	General*
defect occurrence	Music-while-you-work*	Product physical factors*	Isolation of inspectors*
	Workplace design	Complexity	Working in pairs
		2- or 3-dimensional	Effects on sampling scheme*
		Specularity	Motivation*
		Hue	Incentives*
		Size	Product price information
		Defect physical factors	Job rotation*
		Shape	
		Size	
		Specularity	
		Contrast	

The ability of a person to perform an inspection task may be influenced by individual (column 1), environmental (column 2), task (column 3), or organizational (column 4) factors. Those factors that have been identified in industrial experiments are indicated by an asterisk (*); the other factors have been shown to influence inspection performance in laboratory tasks or military studies.

* Identified in industrial experiments.

Searching for Multiple Types of Defects

When several defect conditions must be searched for simultaneously, inspection performance is affected by the ability to keep all defects in mind and search effectively. Aids can be used that permit an inspector to compare a test item to a standard instead of having to make an absolute judgement (*e.g.*, the example sheet of acceptable and unacceptable plastic defects).

Training

Training for inspectors should be mandatory and no on-the-job training. The importance of quality inspection should be clear to the people doing it by providing information about the impact of errors and mistakes. For instance, do embossing operators know what it costs operations for an operator to replace a plastic or a client's customer to be unsatisfied with their credit card?

Feedback

Rapid feedback is important for increasing a worker's inspection performance. Feedback provides motivation, aids training, and maintains standards. Without feedback, workers do not know if they are missing defects or are rejecting/scraping more items than necessary. Eastman Kodak observed a 50% reduction in missed defects when feedback was introduced.

Responsibility

Establishing responsibility and accountability for defect detection is essential to maximize inspection performance. A worker earlier in the system (*e.g.*, a clerk pulling dailies from front stock) who knows that someone else (*e.g.*, an embossing operator) will be inspecting the plastic may not be careful about his inspection process. Unfortunately, the later inspector may not do a thorough inspection since he knows that the lot has already been searched for defects. Job responsibility must be established.