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**DAMAGED
TEXT
IN
ORIGINAL**

EMERGENCY INSTRUCTIONS

FIRE

IF YOU DISCOVER A FIRE:

1. Operate the nearest fire alarm.
2. Ring extension 222, giving – location of fire
– name of person reporting
– any other relevant information
3. If it is safe to do so, tackle the fire with the fire fighting equipment provided.

**THE CONTINUOUS RINGING OF THE FIRE ALARM BELL WILL SIGNIFY
FULL EVACUATION
IF YOU HEAR THE CONTINUOUS RINGING OF THE FIRE ALARM BELL:**

Evacuate the room, floor or building and report to the nearest assembly point in a quiet and orderly manner.

Use the nearest available exit.

Do not stop to collect personal belongings.

Do not use lifts.

Do not re-enter the buildings unless authorised to do so by the Security Staff.

**THE INTERMITTENT RINGING OF THE FIRE ALARM
BELL IS A WARNING THAT AN INCIDENT HAS
BEEN REPORTED. FULL EVACUATION SHOULD NOT
BE INITIATED AT THIS STAGE.**

ACCIDENT

In case of accident contact the department/local first aider, whose name, location and telephone number are displayed on first aid boxes and at strategic points throughout buildings. **DO NOT DELAY** if difficulty is experienced in locating a qualified first aider – ring Security Office, Main Building, extension 222, giving location and brief details of incident and indicate whether a qualified first aider is in attendance.

If it is considered necessary to call for an ambulance, this information together with your name and the exact location of the accident should be passed to the Security Office, extension 222.

OUT OF OFFICE HOURS. Accident calls should be made to the Security Office, Main Building, extension 222, or 359-2922 for outside calls. This office will be manned continuously 24 hours per day, 7 days per week.

HEALTH CENTRE

An urgent call may be made direct to the University Physician at the Health Centre, if the emergency services are not required, by dialling extension 4505 or 4506, or 359-6706 out of office hours.

Start Experiment

Introduction

In the following experiment you will be required to deal with alarms in a simulated nuclear power plant. The task is to assign appropriately the alarm presented as either a non-target or a target alarm. Missing target alarms in a real nuclear power plant would result in a major incident such as in Three Mile Island or Chernobyl. Please try to behave as if you are in the environment described. You will also be required to attend to a secondary task when the primary task allows you to. Please do this experiment to the best of your ability. There will be a £5 first prize in each of the nine groups taking part for the best performance.

You do not have to remember the instructions at this stage, just understand them.

**When you happy that you have understood this Introduction
click on the button below to go to the next page...**

next page...

1

2

3

4

5

4
5
3
2
1
3
4
2
1
4
3
5
3

Please click on the corresponding button to the first highlighted

Your performance

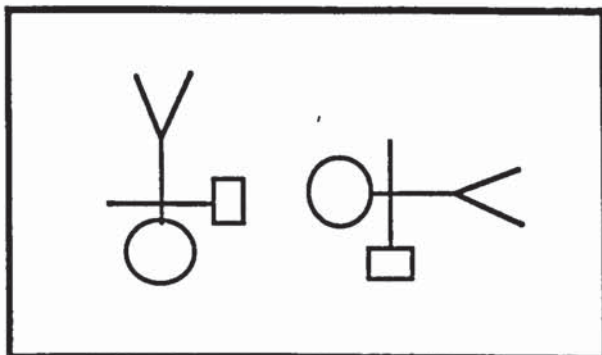
Please click here to go to the next page...

3
4



Please click here to go to the next page...

Please press on the SAME or DIFFERENT keys on the keyboard for this task....Your performance is shown in the box above...



Instructions

You will now be required to do both tasks together as part of an experiment into alarms in a simulated nuclear power plant. The task is to assign appropriately the alarm presented as either a non-target or a target alarm. Missing target alarms in a real nuclear power plant would result in a major incident such as in Three Mile Island or Chernobyl. Please try to behave as if you are in the environment described. You will also be required to attend to a secondary task when the primary task allows you to. Please do this experiment to the best of your ability. There will be a £5 first prize in each of the nine groups for the best performance.

Do you understand the instructions? If not please call the experimenter.

When you happy that you have understood this introduction click on the button below to go to the next page...

next page...

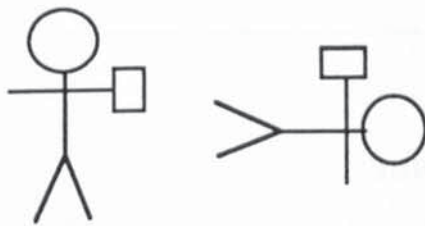
NON TARGET

CORE TEMPERATURE HIGH

LP HTR 1/2 DANGEROUSLY HIGH

PRIMARY CIRCUIT LEAKAGE

DRUM LEVEL HIGH EMERGENCY



TURBINE CONTROL OIL PS FAULTY
SUPERVISORY CHANNEL INOPERATIVE
RE HTR OUTLET STEAM TEMP ABNORMAL
LP HTR 1/2 DANGEROUSLY HIGH
REHEAT SPRAY 71/72 VALUE AT MIN
REHEAT DESUP SPRAY 71/72 HELD OUT
GAS IN COOLANT AUTO VENTING
REHEAT SPRAY 73/74 HELD OUT
SUPERHEATER OUT STEAM TEMP ABNORMAL
CONDENSOR VACUUM LOW
UNLOADING GEAR OPERATING
GAS IN COOLANT AUTO VENTING
FEED SYSTEM PROP TRIPS INOPERATIVE
DESUPERHTR SPRAY PUMP MASTER TRIP
S/S BFP 71 GLAND SEAL FAULT
S/S BFP 72 GLAND SEAL FAULT
S/S BFP AUTO START VETOED
GAS IN COOLANT AUTO VENTING
GAS IN COOLANT AUTO VENTING
HP HEATERS DRAINS TANK LOW WATER LVL
HP HTRS 6&7 BLEED STEAM VALVES INHBTD
DRUM WATER LEVEL ABNORMAL
GAS IN COOLANT AUTO VENTING
DRUM WATER LEVEL EMERGENCY HIGH

Thank you for taking part in this
investigation....

Please call experimenter....

Save RESULTS>>>

Primary

2% 1s

Male

27

Pilot

192543

NTcorrect 1255

NTcorrect 1437

NTcorrect 1398

NTcorrect 1817

NTcorrect 1683

NTwrong 1614

NTcorrect 1560

NTcorrect 1375

NTcorrect 1436

NTcorrect 1298

NTwrong 1534

NTcorrect 1772

NTcorrect 2098

NTcorrect 2024

NTcorrect 1850

NTcorrect 2069

NTcorrect 2192

NTcorrect 2052

NTcorrect 1953

NTcorrect 2080

NTcorrect 2000

T1wrong 2627

NTcorrect 2638

NTcorrect 2652

NTcorrect 2529

NTcorrect 2483

NTcorrect 2877

NTcorrect 2711

NTcorrect 2582

NTcorrect 2395

NTcorrect 2310

NTcorrect 2172

NTcorrect 2070

NTcorrect 1879

NTcorrect 1840

NTcorrect 1616

NTcorrect 1546

NTcorrect 1443

NTcorrect 1307

NTcorrect 1332

NTcorrect 1333

NTcorrect 1433

NTcorrect 1317

NTcorrect 1729

NTcorrect 1575

NTcorrect 1414

NTcorrect 1356



192554

NTcorrect 1330	
NTcorrect 1439	
NTcorrect 1331	
NTcorrect 1328	
NTcorrect 1514	
T3correct 1410	
NTcorrect 1660	
NTcorrect 1542	
NTcorrect 1484	
NTcorrect 1365	
NTcorrect 1424	
T1wrong 1336	
NTcorrect 1621	
NTcorrect 1599	
NTcorrect 1822	
NTcorrect 1774	
T1correct 1715	
NTcorrect 1623	
NTcorrect 1621	
NTcorrect 1534	
NTcorrect 1399	
NTcorrect 1246	
NTcorrect 1242	
NTcorrect 1241	
NTcorrect 1678	
NTcorrect 1552	
NTcorrect 1483	
NTcorrect 1358	
NTcorrect 1402	
NTcorrect 1474	
NTcorrect 2156	
NTcorrect 1947	
NTcorrect 1772	
NTcorrect 1707	
NTcorrect 1592	
NTcorrect 1578	
T2correct 1512	
NTcorrect 1455	
NTcorrect 1457	
NTcorrect 1732	
NTcorrect 1632	
NTcorrect 1504	
NTcorrect 1402	
NTcorrect 1855	
NTcorrect 1717	
NTcorrect 1633	
NTcorrect 1938	
NTcorrect 1956	
NTcorrect 1837	
NTcorrect 1402	

NTcorrect 1910	
NTcorrect 2150	
NTcorrect 1938	
NTcorrect 1812	
NTcorrect 1682	
NTcorrect 1566	
NTcorrect 1421	
NTcorrect 1501	
T2correct 1415	
NTcorrect 1389	
NTcorrect 1485	
NTcorrect 1330	
NTcorrect 1338	
NTcorrect 1323	
T3correct 1360	
NTcorrect 1328	
NTcorrect 1345	
NTcorrect 1344	
NTcorrect 1349	
NTcorrect 1325	
NTcorrect 1360	
NTcorrect 1358	
NTcorrect 1395	
NTcorrect 1500	
NTcorrect 1988	
NTcorrect 1907	
NTcorrect 1913	
NTcorrect 1769	
NTcorrect 1828	
NTcorrect 1646	
T4correct 1602	
T2correct 1642	
NTcorrect 2028	
NTcorrect 2135	
NTcorrect 2048	
NTcorrect 2050	
NTcorrect 1948	
NTcorrect 1818	
T1wrong 1784	
NTcorrect 1793	
NTcorrect 1677	
T1correct 1448	
NTcorrect 2057	
NTcorrect 1965	
NTcorrect 2033	
NTcorrect 1957	
NTcorrect 2202	
NTcorrect 2056	
NTcorrect 1941	

NTcorrect 1944	
NTcorrect 2172	
NTcorrect 2003	
NTcorrect 1821	
NTcorrect 1767	
NTcorrect 1643	
NTcorrect 1508	
NTcorrect 1446	
NTcorrect 1459	
NTcorrect 1397	
NTcorrect 1596	
NTcorrect 1590	
NTcorrect 1651	
T4correct 1599	
NTcorrect 1604	
NTcorrect 1764	
NTcorrect 1574	
NTcorrect 1375	
NTcorrect 1287	
NTcorrect 1377	
NTcorrect 1293	
NTcorrect 1254	
NTcorrect 1502	
NTcorrect 1580	
NTcorrect 1494	
NTcorrect 1407	
NTcorrect 1288	
NTcorrect 1289	
NTcorrect 1359	
NTcorrect 1409	
NTcorrect 1417	
NTcorrect 1933	
NTcorrect 1890	
NTcorrect 1776	
NTcorrect 1690	
NTcorrect 1610	
NTcorrect 1605	
NTcorrect 1592	
NTcorrect 1875	
NTcorrect 1712	
NTcorrect 1598	
NTcorrect 1413	
NTcorrect 1776	
NTcorrect 1753	
NTcorrect 1608	
NTcorrect 1486	
NTcorrect 1466	
NTcorrect 1538	
NTcorrect 1427	

NTcorrect 1566

NTcorrect 1383

NTcorrect 1505

NTcorrect 1478

NTcorrect 1537

NTcorrect 1608

NTcorrect 1484

245386

ANOVA Summary Table for Macintosh HD:StatView II:sdt data

Source of Variation	df	Sum of Squares	Mean Square	F	p	Epsilon Correction
R	2	.039	.020	.769	.4719	
T	2	.174	.087	3.387	.0463	
RT	4	.002	.000	.016	.9994	
Error	32	.820	.026			

Upper Triangle: .05 level ; Lower Triangle: .01 level

	A	B	C
A. T 1	X	S	S
B. T 2	-	X	-
C. T 3	-	-	X

Total secondary task output

Anova table for a 2-factor Analysis of Variance on Y₁: total secondary

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
ratio (A)	2	14885.911	7442.956	1.431	.2523
temporal (B)	2	3842.844	1921.422	.369	.6937
AB	4	7495.289	1873.822	.36	.8351
Error	36	187207.6	5200.211		

There were no missing cells found.

1

The AB Incidence table on Y₁: total secondary

temporal:		one	four	eight	Totals:
ratio	two	5 64.2	5 98	5 85.2	15 82.467
	six	5 68.8	5 50	5 76.8	15 65.2
	ten	5 86.2	5 136.8	5 105.2	15 109.4
Totals:		15 73.067	15 94.933	15 89.067	45 85.689

2

ASTON UNIVERSITY



ALARM HANDLING QUESTIONNAIRE

Neville Stanton

Completion of this questionnaire is voluntary, but I hope that you will take part. It should take no more than 25 minutes. The purpose of this research is to develop an understanding of human reactions to alarm systems to improve future design. A summary of the findings will be made available to you. Thank you for your time and help in completing this questionnaire. Please read the following instructions:

- Your answers are confidential, so please do **not** put your name on the questionnaire.
- There are no right or wrong answers, so just answer as honestly as possible.
- Use the first answer you think of; this is the natural one.
- It is **your** opinion that I am interested in, so please do not seek anyone else's advice.

1. How long have you been a Control Desk Engineer? _____ years.

2. What was the alarm system designed for?

3. What information do you get from alarms?

4. How do you use alarms in your daily activities?

5. Which to you is the more important activity:

a) rectifying an alarm that has already occurred?

b) preventing an alarm from occurring?

please
tick

6. What percentage of your time in alarm handling situations do you spend in the following activities:

% of time

Looking for alarms.....

Assessing the situation.....

Diagnosing the fault.....

Correcting the fault.....

Checking the effects of your actions

7. Do you deliberately scan for alarms every so often? If YES, how often?

Every minute

Every hour

Once per shift

please
tick

8. What proportion of alarms have to be dealt with urgently?

All

Most

Some

None

please
tick

9. When did you, or anyone you have worked with, last miss an alarm?
(remember, this information is confidential and will only be used for
research purposes)

--

approx. date

10. Why was it missed?

Are there other reasons for missing alarms that you can think of? If there are could you list them below:

11. When an alarm occurs what do you typically do?

12. In general, how do you diagnose faults using alarm information?

Most occasions Sometimes Hardly ever

Past experience.....			
Pattern of alarms.....			
Order of occurrence.....			
Other information.....			

please
tick

If other information, then please state:

13. Estimate the percentage of occasions when alarms appear that you are rushed into making decisions:

% of occasions

14. If you are rushed into decisions, do these decisions relate to:

Most occasions Sometimes Hardly ever

Safety.....			
Product.....			
Time schedules....			
Work practices.....			
Other.....			

please
tick

If other, please state:

15. Please rank the following in order of importance to you in your job (1= most important, 6= least important):

Increasing efficiency.....	
Reducing the number of alarms.....	
Following operational procedures	
Ensuring safety.....	
Meeting production targets.....	
Other.....	

If other, please state:

16. Please tick any of the following if they hinder diagnosis of the cause of alarm:

Too little information.....

Too much information.....

Information too difficult to find.....

Information too difficult to interpret..

Other.....

please
tick

If other then please state:

17. Do you ever feel that you are under pressure to clear the alarm display:

from your supervisor

from your colleagues

other

please
tick

If other then please state:

18. Could you give brief examples of what you did:

a) last time an alarm occurred in a critical incident:

Yes

11

No

[illegible][illegible]

20. Do you think that you would resist a change in your alarm system?

Yes	<input type="checkbox"/>	please tick
No	<input type="checkbox"/>	

If YES, please tick which of the following that applies:

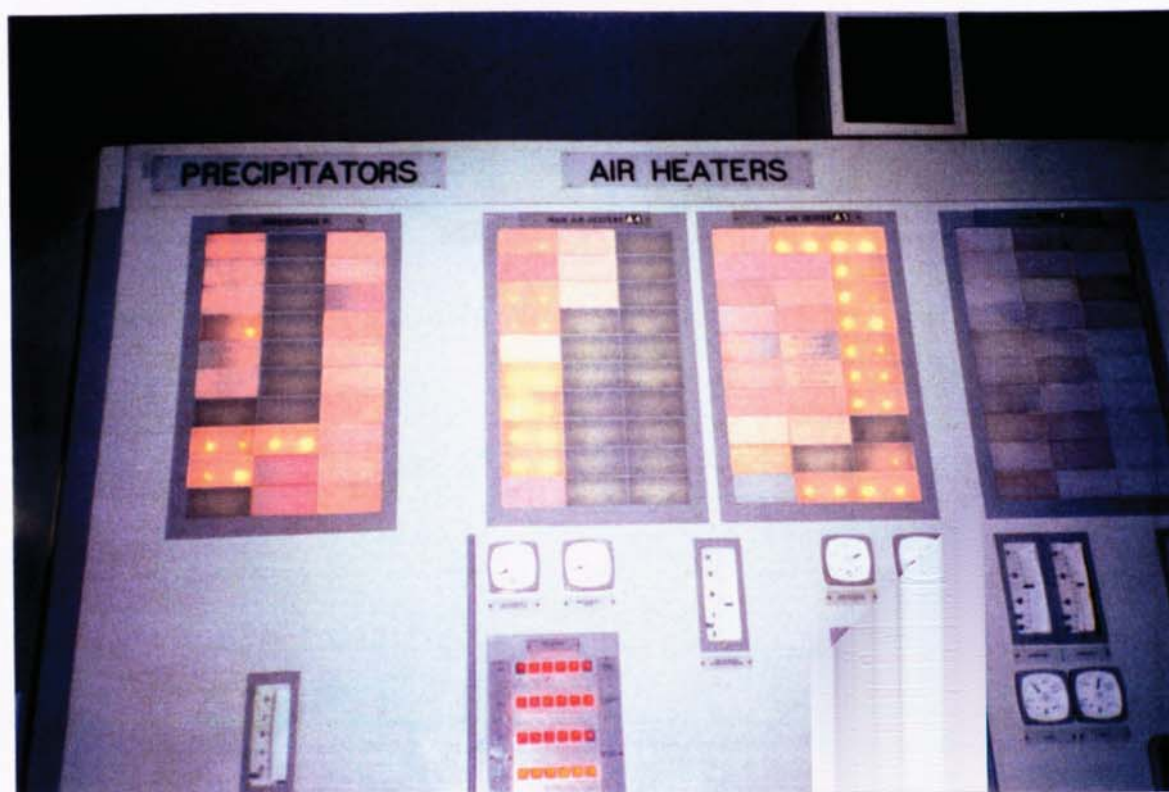
Not sure what new system could offer.....	<input type="checkbox"/>
I know this system well.....	<input type="checkbox"/>
New system will require learning.....	<input type="checkbox"/>
New system might fail.....	<input type="checkbox"/>
Past experience of change.....	<input type="checkbox"/>
More errors likely.....	<input type="checkbox"/>
Good systems are difficult to design	<input type="checkbox"/>
Other.....	<input type="checkbox"/>

If other please state:

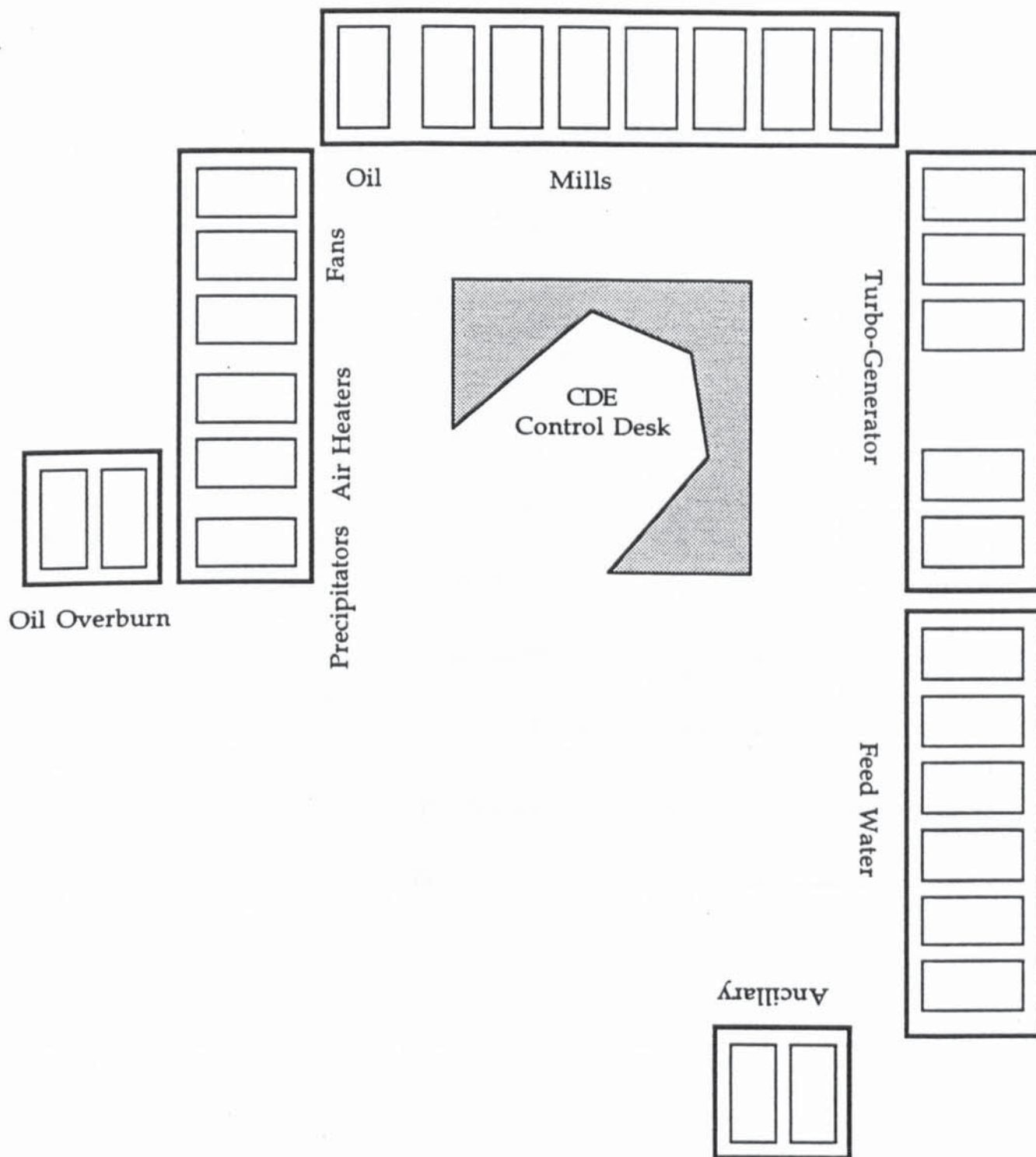
21. Have you used other alarm systems? If you have, did you prefer them and why?

	A	B	C	D	E	F	G	H
1								
2								
3								
4								
5								
6								
7								
8								

Grid Reference System for Annunciator Alarm Panels



Rugeley Control Room



Schematic representation of annunciator panel layout
(not to scale)

	A	B	C	E
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Annunciator tile grid reference

OIL OVERBURN

PRECIPITATORS

AIR HEATERS

FANS

OIL

MILLS

TURBO-GENERATOR

FEEDWATER

ANCILLARY

PANEL	GRID REF	MESSAGE
OIL OVERBURN	7C	AUX BLR B2 WATER LEVEL ABNORMAL
	9C	AUX BLR FLUE GAS OXYGEN LOW
	9D	AUX BLR SMOKE DENSITY HIGH
	2D	O.R.F. TO BOILERS PRESS. CONTROL V/V OPEN/CLOSED
AIR HEATERS 1	1A	MAIN AIR HTRS TEMPERATURE ABNORMAL
AIR HEATERS 2	4A	MILL HTR 71 S'BY LUBE OIL PUMP RUNNING
	5A	MILL HTR 71 GAS OUT DAMP 70% OPEN
	6A	MILL HTR 71 GAS OUT DAMP 20% OPEN
	4B	MILL HTR 72 S'BY LUBE OIL PUMP RUNNING
	5B	MILL HTR 72 GAS OUT DAMP 70% OPEN
	6B	MILL HTR 72 GAS OUT DAMP 20% OPEN
FANS 1	3A	ID 72 A/M STN DISCREPENCY
FANS 3	1A	PA 71 BEARING TEMP HIGH
	1C	O ₂ IN FLUE HIGH/LOW
	3C	MSD HYD PACK 71 LOW OIL LVL
OIL	6A	BOILER LOOP CONTROL AIR PRESS LOW
	9A	SOOT BLOWER FAULT
MILLS	1A	SEAL AIR DIFFERENTIAL LOW
	3A	THRUST BRG OIL FLOW LOW OR STR BLKD
	10A	COAL/AIR TEMP LOW
	5B	FEEDER MOTOR PROT OPER'D
	1C	DAMPER INTERTRIP INHIBITED
TG = TURBO GENERATOR		
TG1	6A	LUB OIL PRESS LOW
	3B	PILOT FLUID FILTER CHOKED
	5B	FEEDER MOTOR PROT OPER'D
	2C	TURNING GEAR FAILED
TG2	4A	HYDROGEN DRYER FAIL
	5A	HIGH PRESSURE GLAND STEAM TEMP HIGH
	6A	HIGH PRESSURE GLAND STEAM TRAP LOW
	3B	H ₂ /SEAL OIL SYSTEM FAULT
	1C	GAS IN COOLANT AUTO VENTING
	3C	COOLING SYSTEM GENERAL FAULT
	1D	GAS IN COOLANT ABNORMAL
TG3	3B	PERM MAGNET GENERATOR 71 FAILURE
	6B	PERM MAGNET GENERATOR 72 FAILURE
TG4	4A	LOW PRESS EXHAUST TEMP HIGH
	5A	LOW PRESS EXHAUST SPRAY OPER'G
	9A	GEN TRANS OIL LEVEL LOW
	9B	TURBINE CONTROL OIL PS FAULTY
	2B	LOW POWER VT SUPPLY FAILED

PANEL	GRID REF	MESSAGE
TG5	2A	EXPANSIONS ABNORMAL
	5A	Q/S AIR EXHAUSTER PROT OPER'D
	6A	SUPERVISORY CHANNEL INOPERATIVE
	9A	RE HTR OUTLET STEAM TEMP ABNORMAL
	8B	REHEAT SPRAY 71/72 VALUE AT MIN
	10B	REHEAT DESUP SPRAY 71/72 HELD OUT
	1C	REHEAT SPRAY 73/74 HELD OUT
	8C	SUPERHEATER SAFETY VALVE LFTD
	10C	SUPERHEATER OUT STEAM TEMP ABNORMAL
	5D	CONDENSER VACUUM LOW
	7D	UNLOADING GEAR OPERATING
FEED WATER 1	1B	FEED SYSTEM PROP TRIPS INOPERATIVE
	7B	DESUPERHTR SPRAY PUMP MASTER TRIP RELAY OPERATED
FEED WATER 2	1B	S/S BFP 71 STANDBY LUB OIL PUMP ON
	7B	S/S BFP 71 GLAND SEAL FAULT
	8B	S/S BFP 72 GLAND SEAL FAULT
	3C	S/S BFP AUTO START VETOED
FEED WATER 3	3C	DC HTR EXT PUMP 74A FILT CHOKED
	6C	DC HTS EXT PUMP 74A PROT OPER'D
FEED WATER 4	8B	HP HEATERS DRAINS TANK LOW WATER LVL
	1C	B. LINE D.A. FLASHBOX LEVEL HIGH
	7C	HP HTRS 6 & 7 BLED STEAM VALVES OPERATION INHIBITED
FEED WATER 5	7A	DRUM WATER LEVEL ABNORMAL
	8A	DRUM WATER LEVEL EMERGENCY HIGH
	1B	DRUM LEVEL SIGNAL LH/RH DISCREPANCY
	3B	BFP TURNING GEAR OIL PRESSURE LOW
	4B	MBFP VIBRATIONS FAULT DETECTED
	7C	BEP 7 TEMP MONITOR WARNING
FEED WATER 6	10A	BFP 7 BEARING OIL PRESSURE LOW
	5B	RECIRC PUMP 71 DIFF TEMP HIGH
	9B	RECIRC PUMP 71 WARM UP VALVE SHUT
	10B	RECIRC PUMP 74 WARM UP VALVE SHUT
	1C	BFP TRIP PLUNGER RESET FAULT
	2C	MBFP AXIAL POSN ABNORMAL
	3C	BFP 7 TEMPERATURE ABNORMAL
	7C	BFP 7 GLAND SEAL INLET PRESSURE LOW
	8C	BFP 7 GLAND SEAL DIFF PRESSURE LOW
ANCILLARY 1	2A	CONDENSATE DISSOLVED OXYGEN HIGH
	5A	SAT STEAM SODIUM HIGH
	9A	ECONOMISER INLET O ² HIGH
ANCILLARY 2	1C	METAL TEMP COLD JUNCTION CUB 71 FAULT
	4C	METAL TEMP COLD JUNCTION CUB 74 FAULT

Phase	Activity	Alarms
1	Fill boiler, start fans, start firing, open vents	No data
2	Close vents, pressure rises	Oil = 4 Mills = 8 T.G. = 6 F/W = 1
3	Warm pipework between boiler and turbine	A.H. = 4 Oil = 1 F/W = 9
4	Vacuum rising, turbine warming, watching turbine for faults	T.G. = 10 F/W = 1
5	Run down, blades expanding too quickly, moving beyond allowable tolerances, allow to cool, wait...	A.H. = 1 Mills = 2 T.G. = 2 F/W = 1
6	Run turbine up to 2000 r.p.m.	Oil = 2 Mills = 3 T.G. = 2
7	Increase firing on boiler, put mills into service, increase load	Oil = 1 Mills = 3 T.G. = 2 F/W = 4

ALARMS BY PHASE IN START-UP

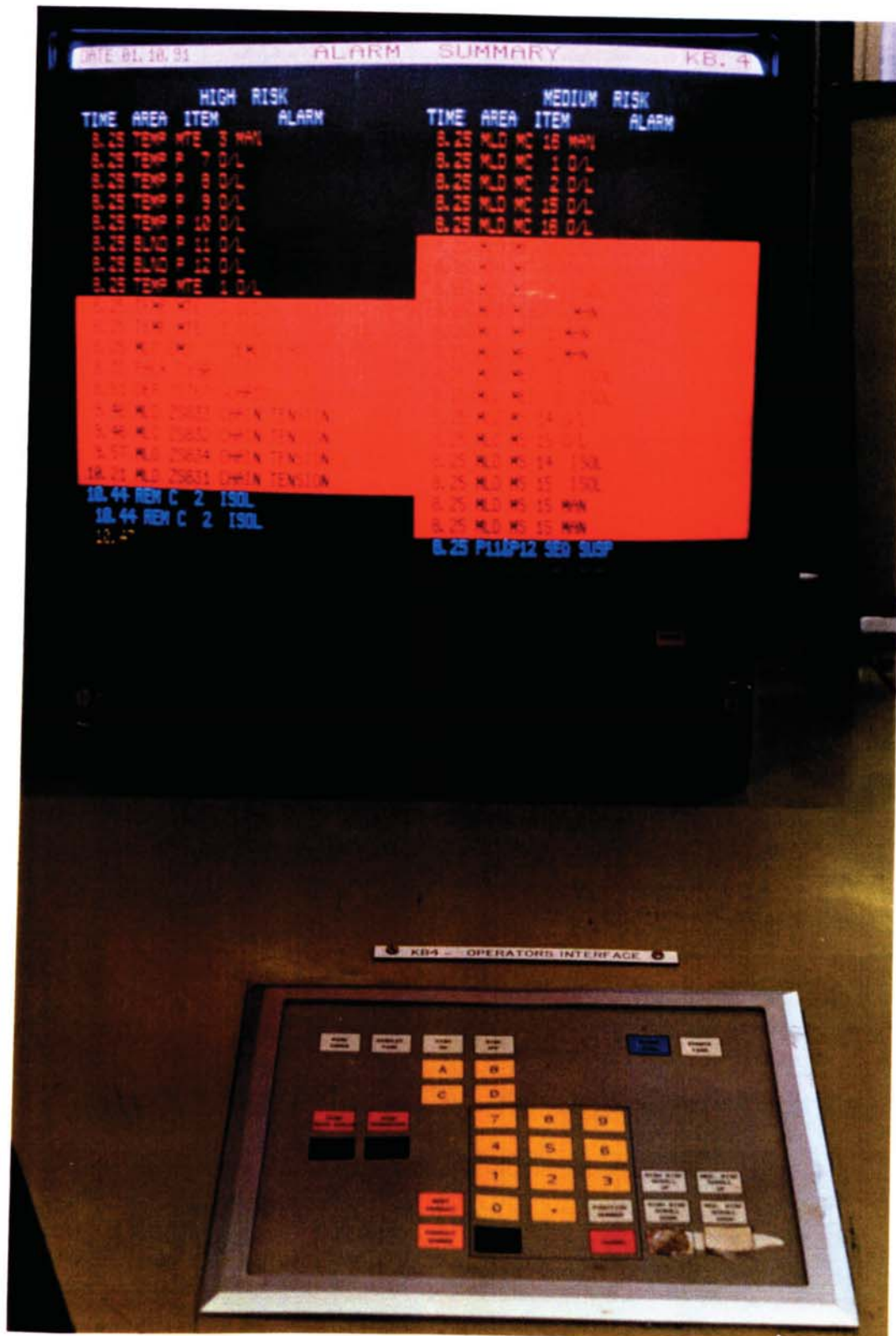
	Alarm	Status Indicator	Maintenance	Total	
Arrive	1] 5	2] 7	3] 5	17	
	E 3.49	E 7.92	E 5.59		
Shift	4] 7	5] 18	6] 14	39	
	E 8.01	E 18.16	E 11.84		
Depart	7] 3	8] 9	9] 5	17	
	E 3.49	E 7.92	E 5.59		
TOTAL	15	34	24	73	GRAND TOTAL

$$\begin{aligned}
 \text{Cell 1: E} &= \frac{15 \times 17}{73} = 3.49 &= \frac{(5 - 3.49)^2}{3.49} = 1.51 \\
 \text{Cell 2: E} &= \frac{34 \times 17}{73} = 7.92 &= \frac{(7 - 7.92)^2}{7.92} = 0.11 \\
 \text{Cell 3: E} &= \frac{24 \times 17}{73} = 5.59 &= \frac{(5 - 5.59)^2}{5.59} = 0.06 \\
 \text{Cell 4: E} &= \frac{15 \times 39}{73} = 8.01 &= \frac{(7 - 8.01)^2}{8.01} = 0.13 \\
 \text{Cell 5: E} &= \frac{34 \times 39}{73} = 18.16 &= \frac{(18 - 18.16)^2}{18.16} = 0 \\
 \text{Cell 6: E} &= \frac{24 \times 36}{73} = 11.84 &= \frac{(14 - 11.84)^2}{11.84} = 0.39 \\
 \text{Cell 7: E} &= \frac{15 \times 17}{73} = 3.49 &= \frac{(3 - 3.49)^2}{3.39} = 0.07 \\
 \text{Cell 8: E} &= \frac{34 \times 17}{73} = 7.92 &= \frac{(9 - 7.92)^2}{7.92} = 0.15 \\
 \text{Cell 9: E} &= \frac{24 \times 17}{73} = 5.59 &= \frac{(5 - 5.59)^2}{5.59} = 0.06 \\
 \chi^2 &= \frac{(O - E)^2}{E} &= 2.48
 \end{aligned}$$

df = 4 Not significant

Minimum Character Size for Displays and Legends

Distance	Routine marking with high illumination (mm)	Critical marking with high illumination or routine marking with low illumination (mm)	Critical marking with low illumination (mm)
36 cm	0.76	1.3	2.0
71 cm	1.3	2.5	3.8
91 cm	1.5	3.3	4.8
1.5 mtrs	2.8	5.3	8.1
3.0 mtrs	5.6	11.0	16.5
6.1 mtrs	11.0	22.0	33.0



Moulding 1
Appendix G 1



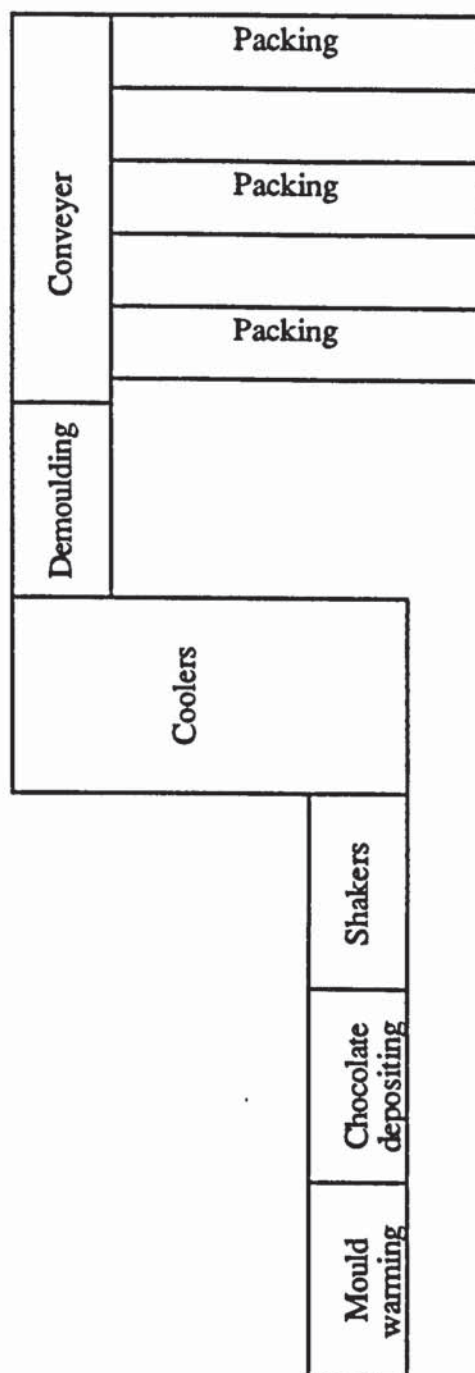
Moulding 2

Appendix G 2



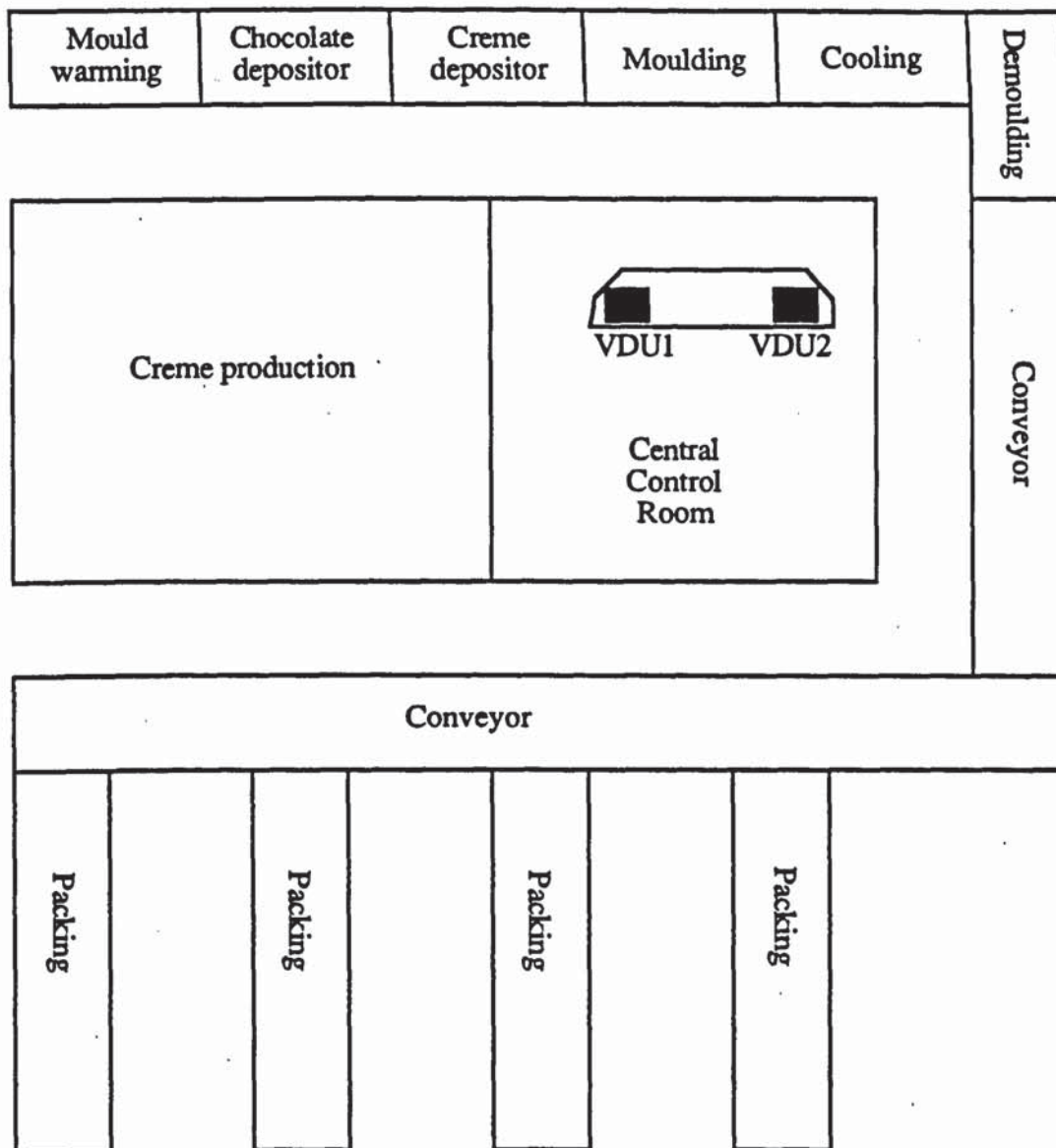
Moulding 3

Appendix G 3



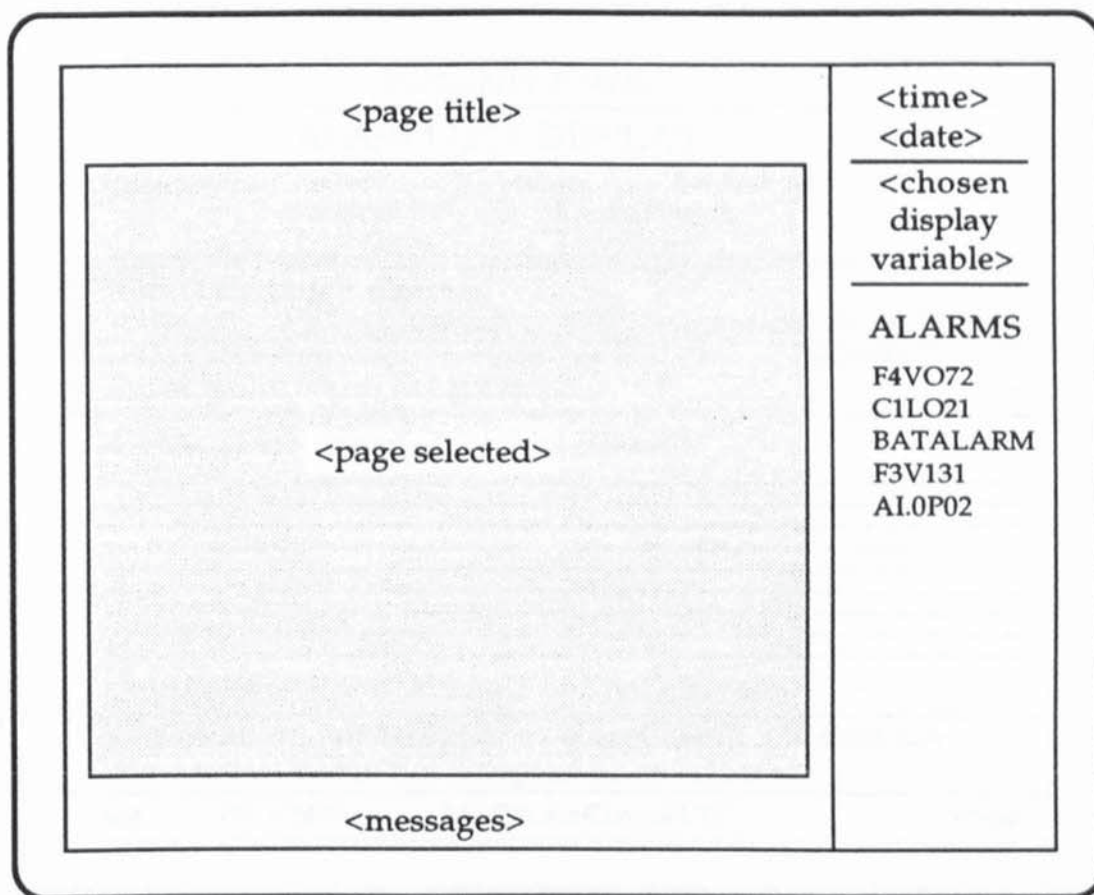
Appendix G 4


Plant components for Plants 1 & 3 (schematic representation only)



Appendix G 5
Plant components for Plant 2 (schematic representation only)

Appendix G 6
Alarm screen for Plant 1



		DEXTERITY SCREEN	
ALARM LIST DISPLAY			
Option keys	7 = top, 4 = scroll fwd, 1 = fwd one,	9 = bottom, 5 = scroll back, 2 = back one	8 = first acknowledged alarm,
<oldest alarm not accepted		>	
<most recent alarm not accepted		>	
<oldest alarm accepted but not cleared>			
<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>			
<most recent alarm accepted but not cleared>			
<oldest alarm not accepted or oldest alarm not cleared>			
<next oldest alarm not accepted or not cleared>			
User:	PROCENG	S&I Process Control LTD	<time>

ALARMS PER SHIFT: DAY 2

P
L
A
N
T

	O	P x N = E	[O - E] = D	$\frac{D^2}{D}$	$\frac{D^2}{E}$
1	529	$1/3 \times 1544 = 514.7$	14.3	204.49	0.397
2	204	$1/3 \times 1544 = 514.7$	310.7	96534.49	187.55
3	811	$1/3 \times 1544 = 514.7$	296.3	87793.69	170.57
	<u>1544</u>				<u>358.517</u>

$$\therefore \chi^2_2 = 358.517; p < 0.01$$

STANDING ALARMS: DAY 2

P
L
A
N
T

	O	P x N = E	[O - E] = D	D ²	$\frac{D^2}{E}$
1	25	1/3 x 45 = 15	10	100	6.66
2	5	1/3 x 45 = 15	10	100	6.66
3	15	1/3 x 45 = 15	0	0	0
	<u>45</u>				<u>13.22</u>

$$\chi^2_2 = 13.32; p < 0.01$$

ALARMS vs. SI: DAY 2

P
L
A
N
T

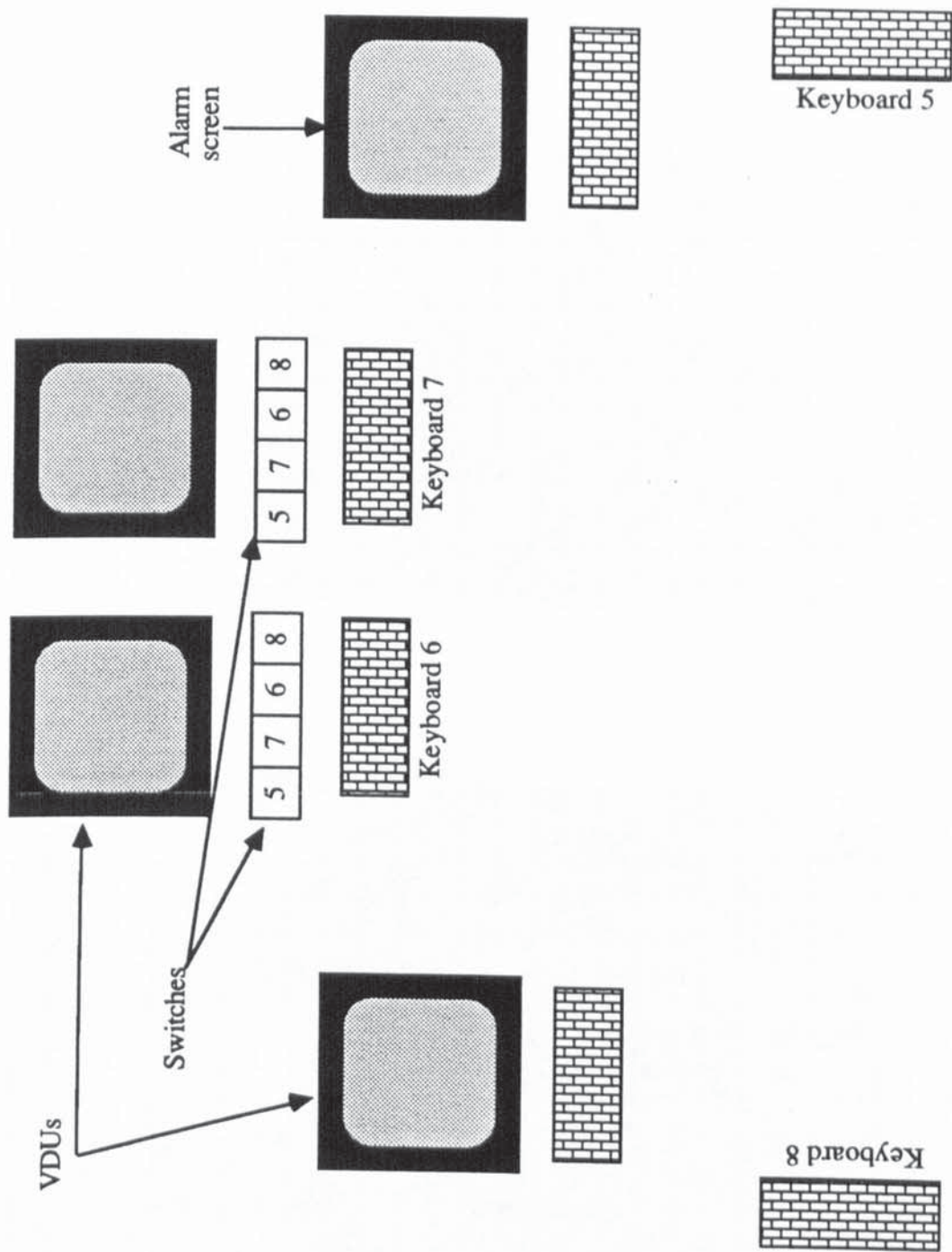
	O	P x N = E	[O - E] = D	D ²	$\frac{D^2}{E}$
1	5	$1/3 \times 16 = 5.33$	0.33		0.02
2	3	$1/3 \times 16 = 5.33$	2.33	5.43	1.02
3	8	$1/3 \times 16 = 5.33$	2.67	7.13	1.34
	<u>16</u>				<u>2.38</u>

$$\chi^2_2 = 2.38; p = \text{not significant}$$

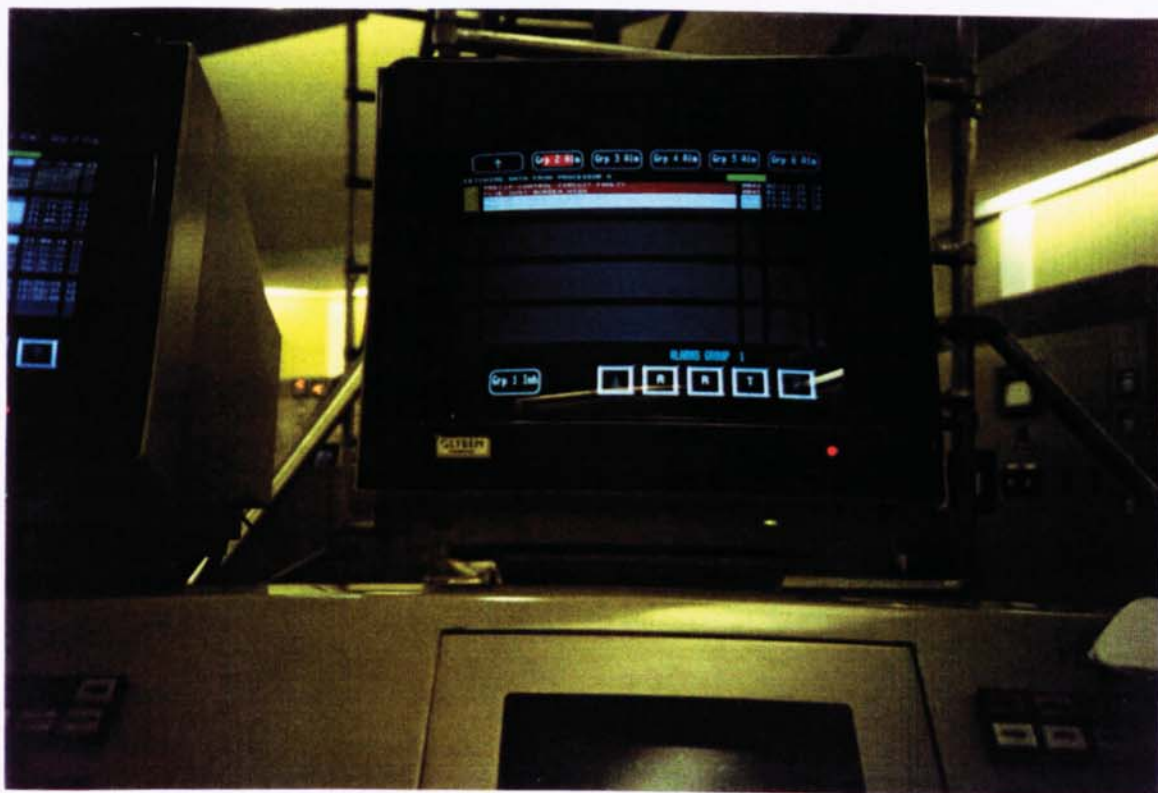
OSCILLATIONS : DAY 2

O	P x N = E	[O - E] = D	D ²	$\frac{D^2}{E}$
191	1/3 x 234 = 78	113	12769	163.7
17	1/3 x 234 = 78	61	3721	47.7
26	1/3 x 234 = 78	52	2704	34.7
<u>234</u>				<u>246.1</u>

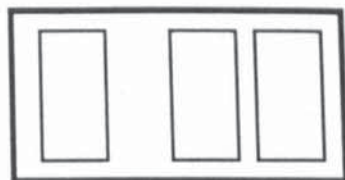
$$\chi^2_2 = 246.1; \quad p < 0.01$$



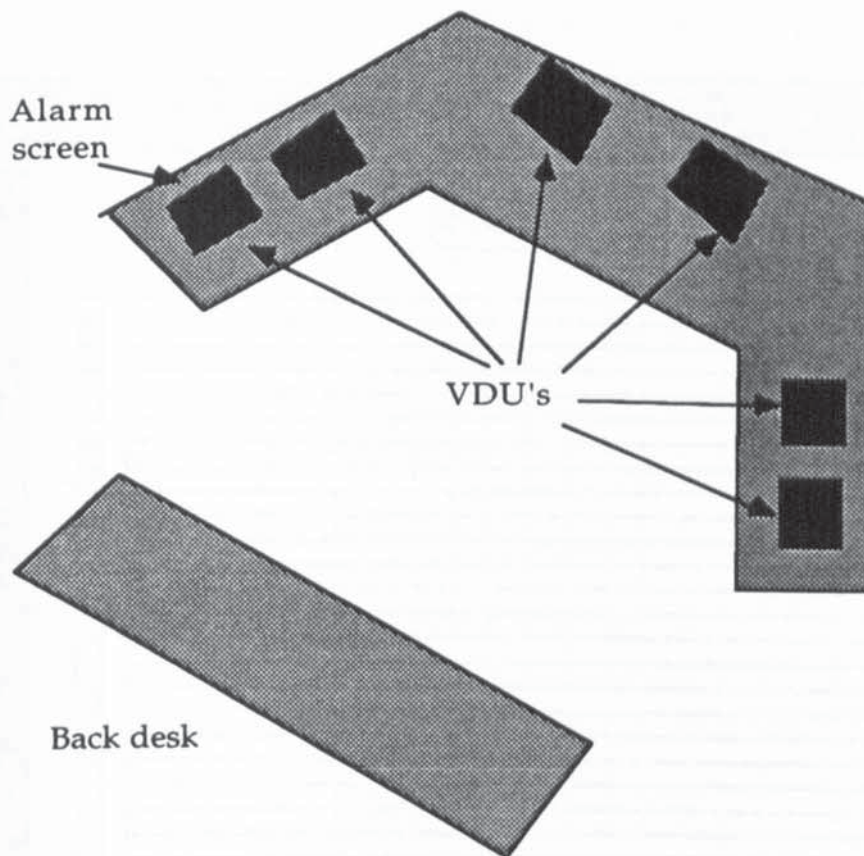
Appendix G 13
Switch & keypad in Plant 1



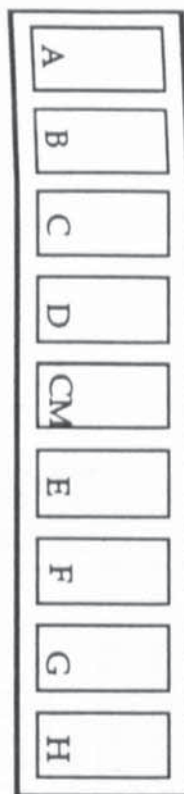
Didcot Control Room



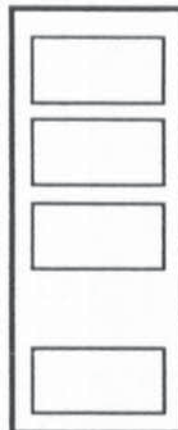
Air Heaters



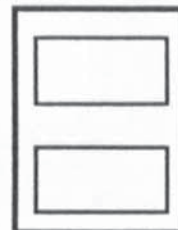
Mills A-H



Feedwater



Turbine



Generator



Schematic representation of annunciator panel layout
(not to scale)

The image shows a schematic of an alarm screen for plant area 2. It features a central display area with four rows of horizontal bars, each preceded by a vertical column of five small squares. Above the display are six buttons labeled 'Grp 1 Alm', an upward arrow, 'Grp 3 Alm', 'Grp 4 Alm', 'Grp 5 Alm', and 'Grp 6 Alm'. Below the display is a button labeled 'Grp 2 Alm' and a row of five buttons: an upward arrow, 'A', 'R', 'T', and a downward arrow.

Alarm screen for plant area 2

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Grid reference for recording alarms

Appendix H 4

DRAUGHT A

1. SOOTBLOWER EQUIPMENT FAULT
4. DIAMOND BLOWERS FAULT
7. 48 VOLT SOOTBLOWER CONTROL CCT FAILURE

DRAUGHT B

6. PRECIP A RAPPING GEAR FAULT
30. FLUE DUST BURDEN HIGH

DRAUGHT C

MILLS

1. PA FAN A OVERLOADED OR TRIPPED
2. MILL A TRIP
3. MILL A LUB OIL FAILURE
4. FEEDER A TRIP
5. PA FAN A TEMPS HIGH
6. MILL A STANDING TEMP HIGH
7. MILL A BEARING TEMP HIGH
8. FEEDER A LOCAL STOP
9. PA FAN A LUB OIL FAILURE
10. MILL A OUTLET TEMP HIGH
11. MILL A STALLED
12. FEEDER A STALLED
13. PA FAN A VENT FAN TRIP
14. MILL A BALL LOADING FAULT
15. MILL A DF BURNING FLAME FAIL
- 16.
- 17.
18. MILL A MOTOR TEMP HIGH
19. MILL A OIL BURNING FLAME FAIL
20. MILL A FIRE
- 21.
- 22.
- 23.
24. MILL A FIRE ALARM FAULT

COMBUSTION MASTER

14. PF FLAME MONITOR FAULTY

FB

4. SEQ EQUIPT BOILER CUBICLES 1-6 FAULTY
15. 415 V UNIT BLR SW BD.B TRIP CIRCUIT FAULTY
18. STEAM SODIUM LEVEL HIGH

FC

8. CLEAN DRAINS TANK LEVEL LOW
13. SUPERHEATER B2 OUTLET TEMP HIGH

FD

10. S & S FEED PUMP A DISCHARGE PRESS LOW
14. S & S FEED PUMP B DISCHARGE PRESS LOW
17. S & S FEED PUMP A LEAK OFF IN PROGRESS
21. S & S FEED PUMP B LEAK OFF IN PROGRESS

TA

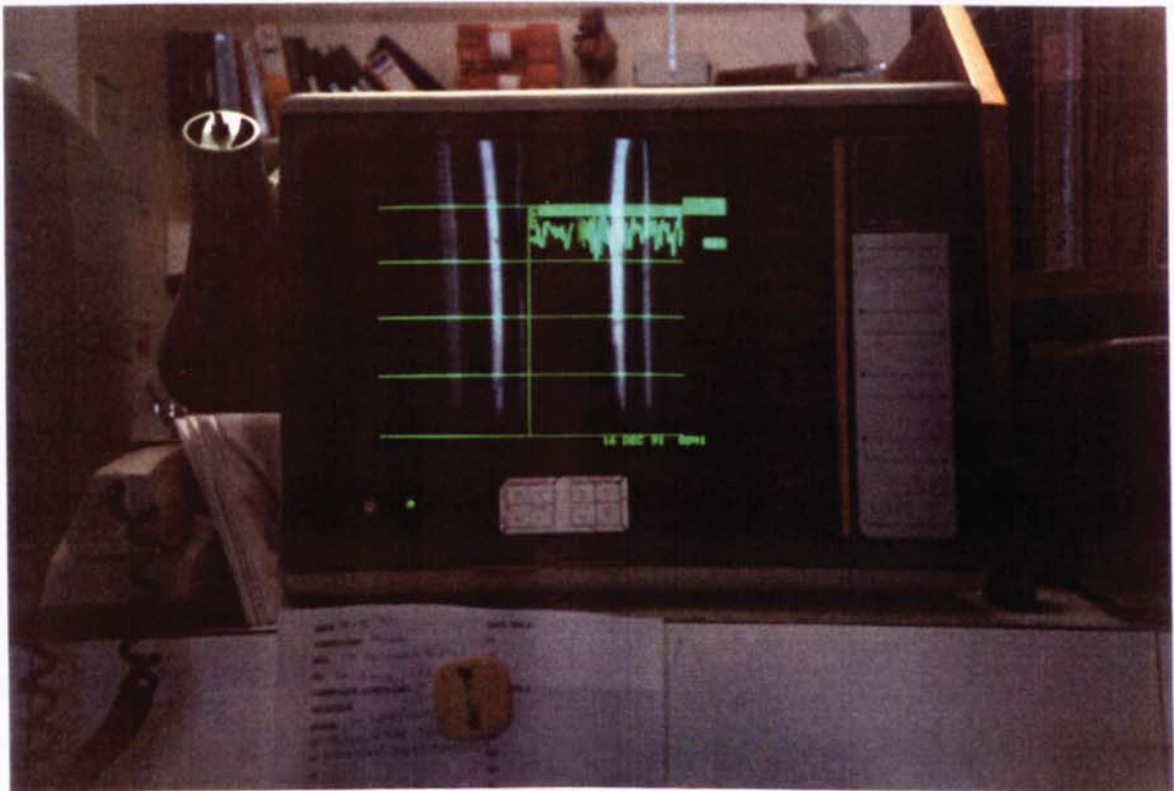
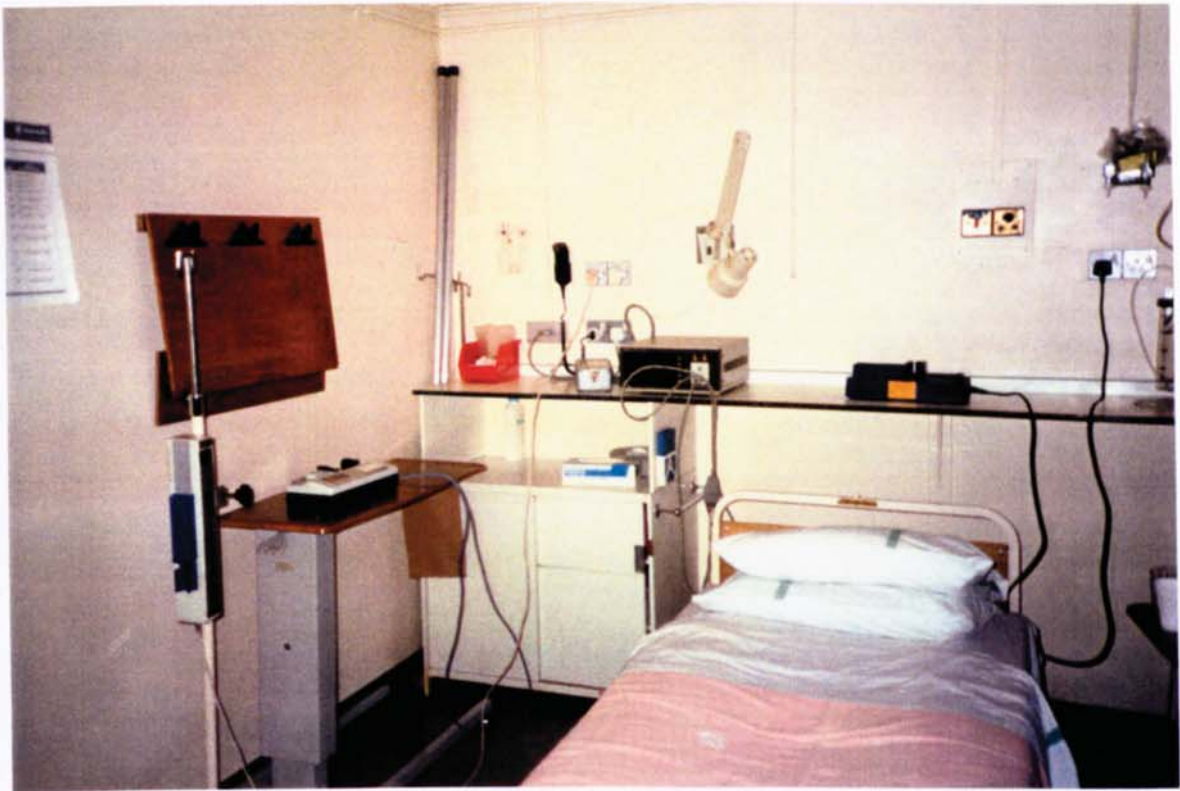
1. TURB FP TURB STOP VALVE CLOSED
21. FEEDPUMPS GLAND DRAIN TANK LEVEL HIGH

PLANT PHASES CHI² ANALYSIS

PHASES	O	P x N = E	[O-E] = D	D ²	D ² /E
Shutdown	60.0	$\frac{1}{4} \times 93.9 = 23.5$	36.5	1332.25	56.69
Shut	5.6	$\frac{1}{4} \times 93.9 = 23.5$	-17.9	320.41	13.63
Startup	21.0	$\frac{1}{4} \times 93.9 = 23.5$	-2.5	6.25	0.26
Normal	7.3	$\frac{1}{4} \times 93.9 = 23.5$	-16.2	262.44	262.44
	<u>93.9</u>				<u>333.02</u>
	rate per hour				

$$\chi^2_3 = 333.02 \quad P < 0.001$$

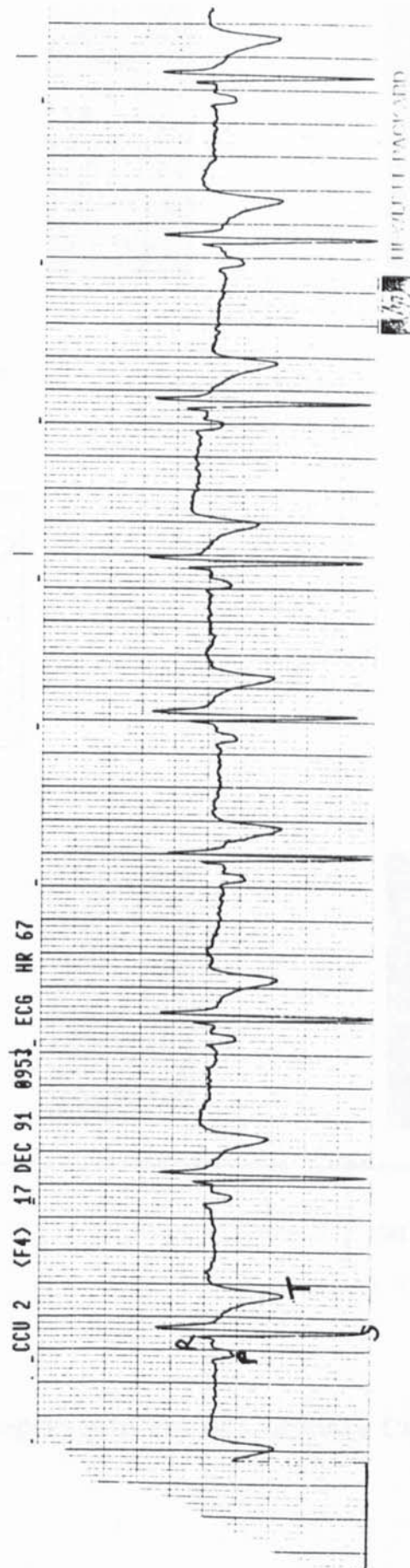
Appendix H 6 Chi-square of alarms by phase



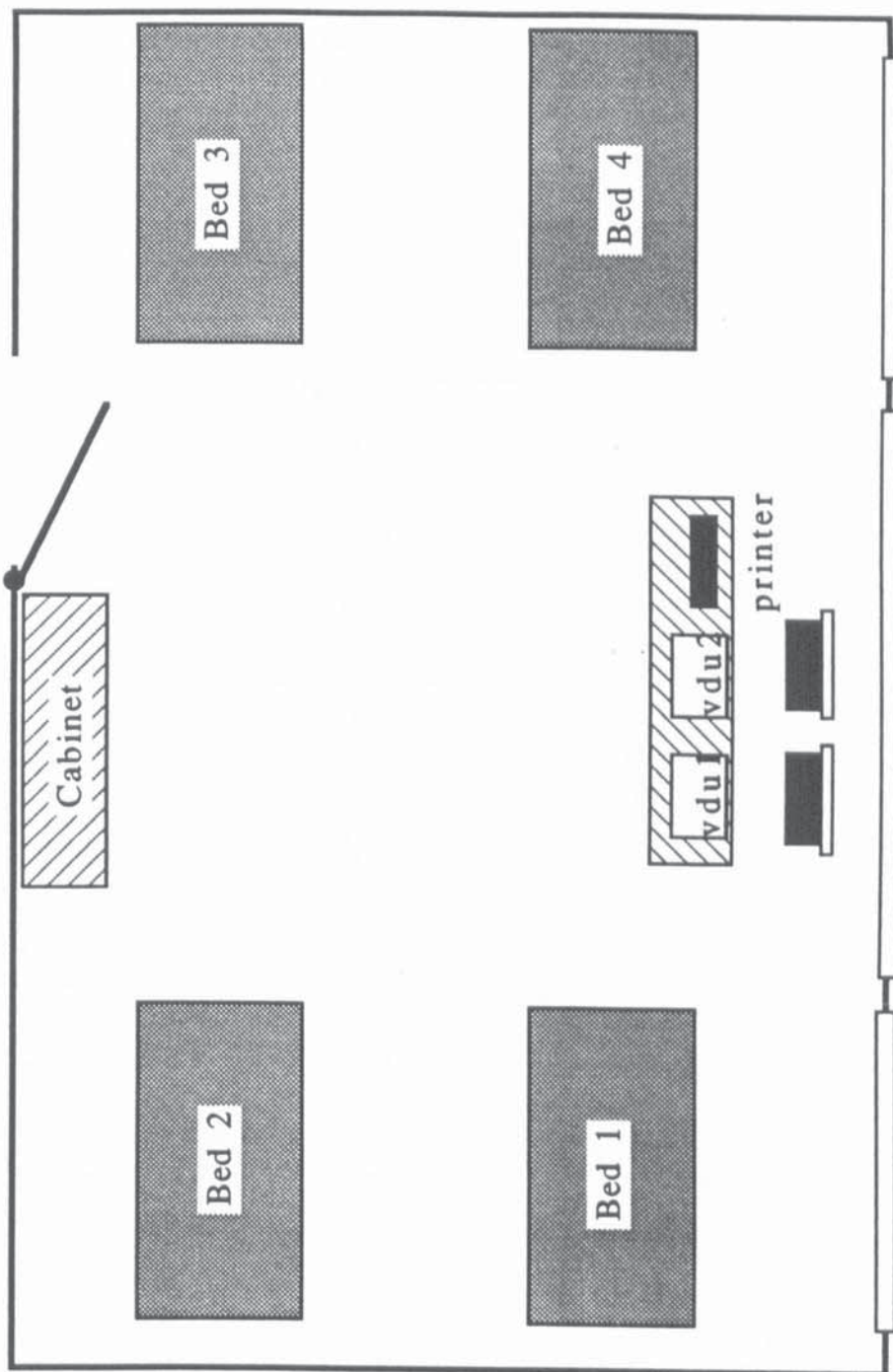
Coronary Care Unit

Appendix I 2

Screen layout of ECG Monitor: VDU 2



Print-out from ECG Monitor



Plan of Coronary Care Unit

Appendix I 4

Schematic representation of Coronary Care Unit (not to scale)

TOTAL ALARMS χ^2 ANALYSIS

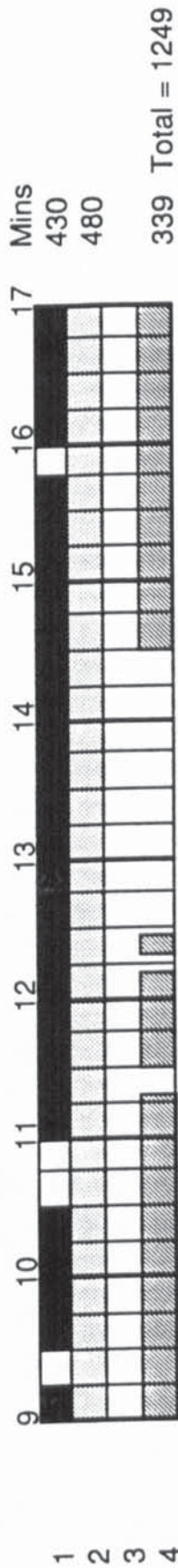
Obs	O	P x N = E	[O - E] = D	D ²	D ² /E
Day 1	39	1/3 x 109 = 36.33	2.67	7.13	0.196
Day 2	34	1/3 x 109 = 36.33	-2.33	5.43	0.149
Day 3	36	1/3 x 109 = 36.33	-0.33	0.11	0.0003
	109				0.2289

$\chi^2_2 = 0.2289$ p = not significant

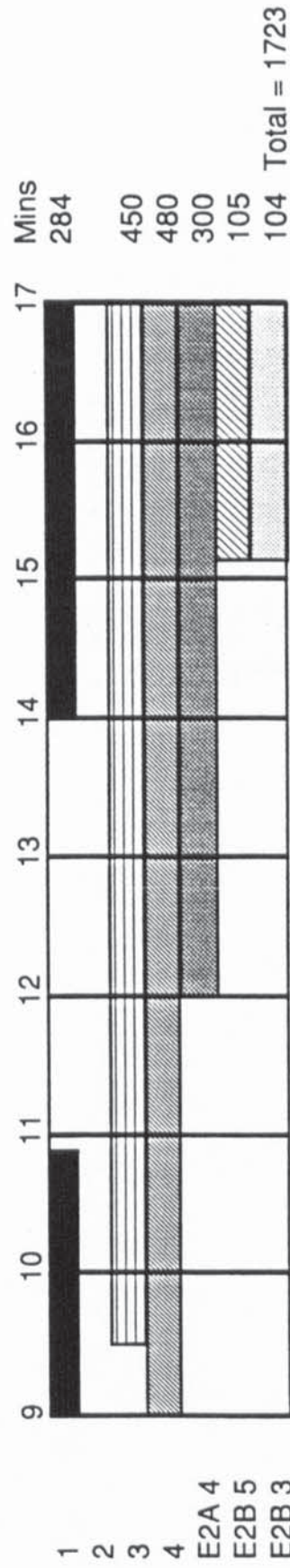
Appendix I 5

ECG on = Shaded area

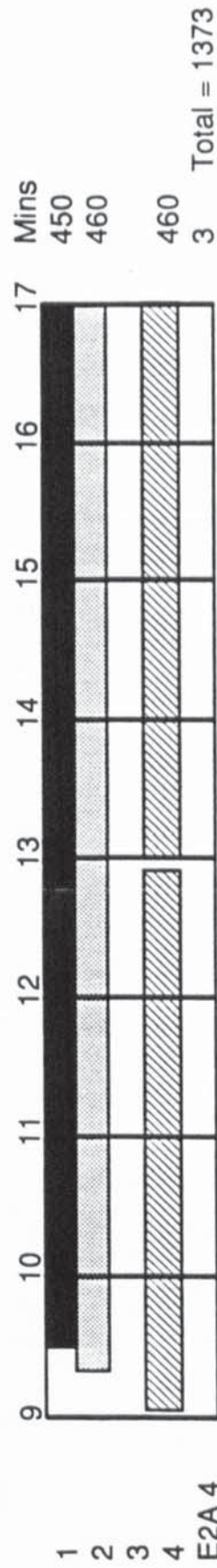
Day 1



Day 2



Day 3



ECG alarms per hour:

Day	Alarms per hour	Pumps	Total alarms	Total hours ECG on
1	1.34	11	28 (not inc. pumps)	20.82
2	1.11	2	32 (not inc. pumps)	28.72
3	1.53	1	35 (not inc. pumps)	22.88

CHI² OF ECG AVAILABILITY

Obs	O	P x N = E	[O - E] = D	D ²	D ² /E
Day 1	20.82	1/3 x 72.42 = 24.14	-3.32	11.02	0.46
Day 2	28.72	1/3 x 72.42 = 24.14	4.58	20.98	0.87
Day 3	22.88	1/3 x 72.42 = 24.14	-1.59	1.59	0.06
	72.42				1.39

$\chi^2_2 = 1.39$ p = not significant

Appendix I 7

EEG ALARMS PER 10 HOURS OPERATIONAL

Obs	O	P x N = E	[O - E] = D	D ²	D ² /E
Day 1	13.4	1/3 x 39.8 = 13.27	0.13	0.017	0.000127
Day 2	11.1	1/3 x 39.8 = 13.27	-2.17	4.71	0.35485
Day 3	15.3	1/3 x 39.8 = 13.27	2.03	4.12	0.3105
	39.8				0.665477

$\chi^2_2 = 0.665477$ p = not significant

Appendix I 8

CHI² ANALYSIS OF URGENCY & FREQUENCY

	HIGH	MED	LOW	TOTAL
DAY 1	1 7	2 15	3 17	39
	E 8.94	E 10.73	E 19.32	
DAY 2	4 10	5 6	6 18	34
	E 7.8	E 9.36	E 16.84	
DAY 3	7 8	8 9	9 19	36
	E 8.26	E 9.91	E 17.83	
TOTAL	25	30	54	109

CELL 1: $E = \frac{39 \times 25}{109} = 8.94$	$\frac{(7 - 8.94)^2}{8.94} = 0.42$
CELL 2: $E = \frac{39 \times 30}{109} = 10.73$	$\frac{(15 - 10.73)^2}{10.73} = 1.7$
CELL 3: $E = \frac{39 \times 54}{109} = 19.32$	$\frac{(17 - 19.32)^2}{19.32} = 0.28$
CELL 4: $E = \frac{34 \times 25}{109} = 7.8$	$\frac{(10 - 7.8)^2}{7.8} = 0.62$
CELL 5: $E = \frac{34 \times 30}{109} = 9.36$	$\frac{(6 - 9.36)^2}{9.36} = 1.21$
CELL 6: $E = \frac{34 \times 54}{109} = 16.84$	$\frac{(18 - 16.84)^2}{16.84} = 0.08$
CELL 7: $E = \frac{36 \times 25}{109} = 8.26$	$\frac{(8 - 8.26)^2}{8.26} = 0.0008$
CELL 8: $E = \frac{36 \times 30}{109} = 9.91$	$\frac{(9 - 9.91)^2}{9.91} = 0.08$
CELL 9: $E = \frac{36 \times 54}{109} = 17.83$	$\frac{(19 - 17.83)^2}{17.83} = 0.08$
	TOTAL <u>4.4708</u>

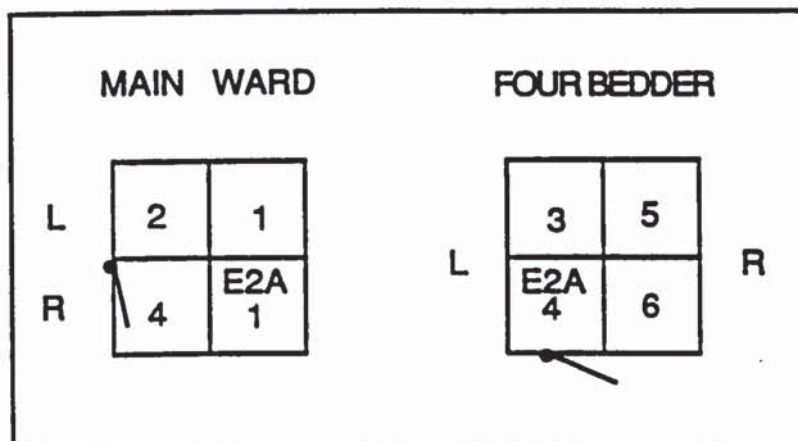
$$Z^2 = \frac{(O - E)^2}{E}$$

df = 4

$$Z_4^2 = 4.4708 \text{ p} = \text{not significant}$$

MAIN WARD		
E2B	E2A	E2A
R 4	1	2

STICKER UNDER SCREEN OF VDU 1



STICKER UNDER SCREEN OF VDU 2

VDU labels of bed position on Wards

Pages removed for copyright restrictions.

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor will be able to detect variation in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will transmit information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment, you will be asked to take the role of a member of supermarket control room staff. You will hear twenty seven spoken messages. Each message will consist of three words: the product container; the product; and the problem. These are listed, in the vocabulary section, below.

You will listen to each command and assess its urgency. On page two, there are three columns, labelled: Low; Medium; and High. There is also a column for Don't Know. You have to put a circle around the number of the command in the column which you think describes the urgency of that command. After each command there will be a pause of ten seconds. This is quite a short time, so you will have to work quickly.

Vocabulary

Container

Bag
Bottle
Box

Jar
Loose
Packet

Shrinkwrapped
Tin
Wrapped

Product

Apple
Apple Sauce
Beef
Bread

Carrot
Celery
Chocolate
Corned Beef
Crumpets
Custard

Edam
Flour
Gataeux
Milk
Mop
Nuts

Oil
Pickles
Pork
Sam Smiths
Saucepan
Sausages

Sugar
Tomato
Washing Liq

Problem (in order of Urgency)

LOW

MEDIUM

HIGH

Misplaced
Dressing
Returns

Price
Low
Past Date

Empty
Spillage
Breakage

Rating for Urgency

Level of Urgency			
LOW	MEDIUM	HIGH	DON'T KNOW
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor will be able to detect variation in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will transmit information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment, you will be asked to take the role of a member of supermarket control room staff. You will hear twenty seven spoken messages. Each message will consist of three words: the product container; the product; and the problem. These are listed, in the Vocabulary section, below.

You will listen to each command and write down the words you have heard. After each command there will be a pause of ten seconds. This is quite a short time, so you will have to work quickly. If you do not know a word, then draw a line (_____). Make sure that you record the commands as three words, e.g.

"Tin _____ Price"

Vocabulary

Container

Bag
Bottle
Box

Jar
Loose
Packet

Shrinkwrapped
Tin
Wrapped

Product

Apple
Apple Sauce
Beef
Bread

Carrot
Celery
Chocolate
Corned Beef
Crumpets
Custard

Edam
Flour
Gataeux
Milk
Mop
Nuts

Oil
Pickles
Pork
Sam Smiths
Saucepan
Sausages

Sugar
Tomato
Washing Liq

Problem (in order of Urgency)

LOW

Misplaced
Dressing
Returns

MEDIUM

Price
Low
Past Date

HIGH

Empty
Spillage
Breakage

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor will be able to detect variation in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will transmit information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment, you will be asked to take the role of a member of supermarket control room staff. You will hear twenty seven spoken messages. Each message will consist of three words: the product container; the product; and the problem. These are listed, in the vocabulary section, below.

You will listen to each command and mark the location of the problem on a map. On page two, there is a map of the supermarket. You have to write the number of the command in the location which you think relates to the command. The first command you hear will be number one, the second command will be number two etc. After each command there will be a pause of ten seconds. This is quite a short time, so you will have to work quickly.

Vocabulary

Container

Bag
Bottle
Box

Jar
Loose
Packet

Shrinkwrapped
Tin
Wrapped

Product

Apple
Apple Sauce
Beef
Bread

Carrot
Celery
Chocolate
Corned Beef
Crumpets
Custard

Edam
Flour
Gataeux
Milk
Mop
Nuts

Oil
Pickles
Pork
Sam Smiths
Saucepan
Sausages

Sugar
Tomato
Washing Liq

Problem (in order of Urgency)

LOW

Misplaced
Dressing
Returns

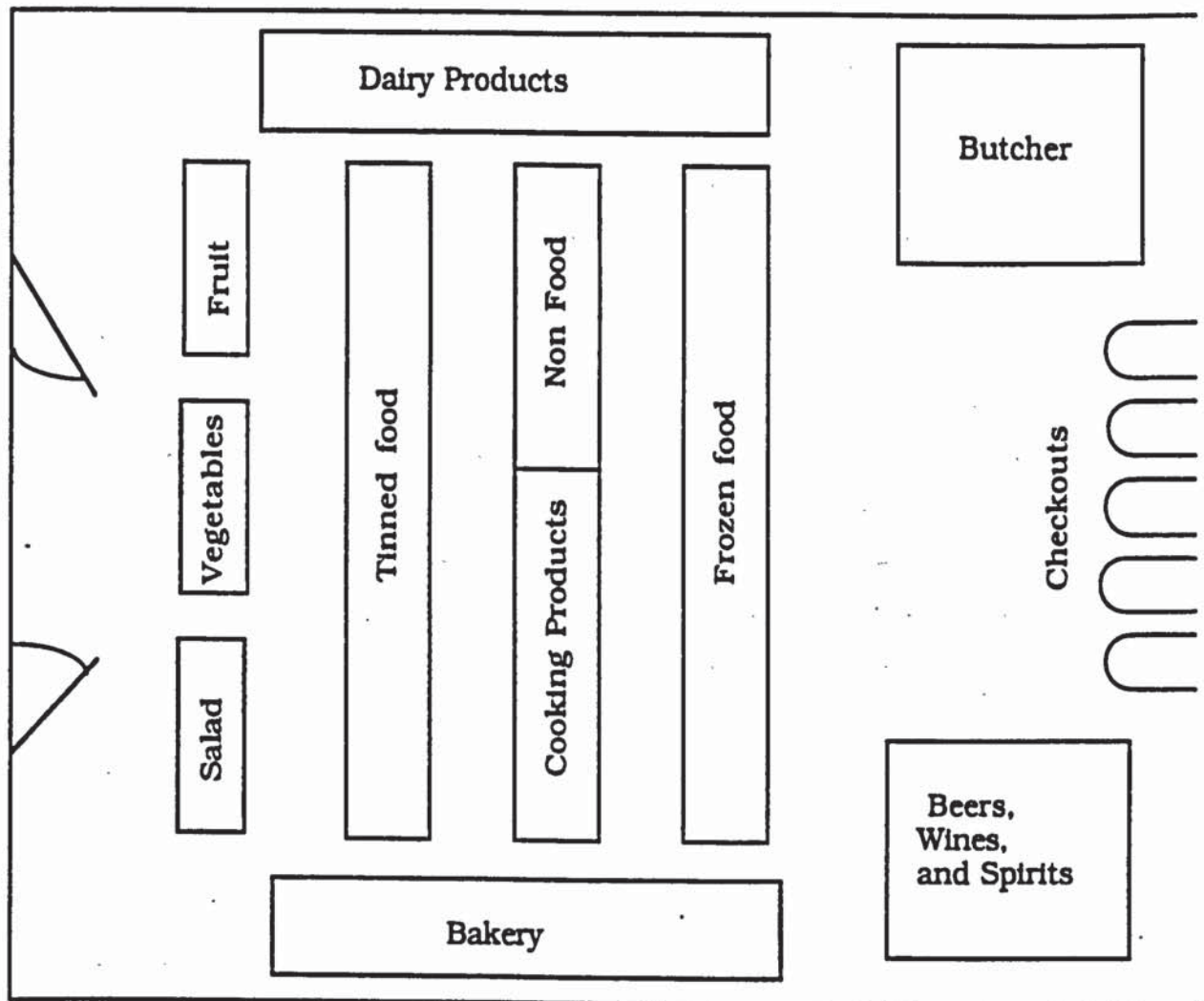
MEDIUM

Price
Low
Past Date

HIGH

Empty
Spillage
Breakage

Map of Supermarket



Task performance (human vs synthesis)

Kruskal-Wallis X₁ : GROUP Y₁ : data

DF	5	
* Groups	6	
* Cases	58	
H	42.35	p = .0001
H corrected for ties	43.34	p = .0001
* tied groups	12	

Kruskal-Wallis X₁ : GROUP Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
urgenthuman	10	419.5	41.95
urgentcomputer	10	333.5	33.35
recordhuman	10	489	48.9
recordcomputer	10	121.5	12.15
locatehuman	11	298.5	27.14

Kruskal-Wallis X₁ : GROUP Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
locatecomputer	7	49	7

Task performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
recordhuman	10	155	15.5
recordcomputer	10	55	5.5
U		0	
U-prime		100	
Z		-3.78	p = .0002
Z corrected for ties		-3.97	p = .0001
* tied groups		4	

Task performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
locatehuman	11	142	12.91
locatecomputer	7	29	4.14
U		1	
U-prime		76	
Z		-3.4	p = .0007
Z corrected for ties		-3.42	p = .0006
* tied groups		5	

Task performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
urgenthuman	10	127	12.7
urgentcomputer	10	83	8.3
U		28	
U-prime		72	
Z		-1.66	p = .0963
Z corrected for ties		-1.7	p = .0885
* tied groups		4	

Task performance (human)

Kruskal-Wallis X₁ : GROUP Y₁ : data

DF	2	
* Groups	3	
* Cases	31	
H	14.54	p = .0007
H corrected for ties	16.43	p = .0003
* tied groups	6	

Kruskal-Wallis X₁ : GROUP Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
urgenthuman	10	177.5	17.75
recordhuman	10	229.5	22.95
locatehuman	11	89	8.09

Task performance (human)

Mann-Whitney U X 1 : GROUP Y 1 : data

	Number:	Σ Rank:	Mean Rank:
recordhuman	10	163.5	16.35
locatehuman	11	67.5	6.14

U	1.5	
U-prime	108.5	
Z	-3.77	p = .0002
Z corrected for ties	-3.93	p = .0001
* tied groups	5	

Task performance (human)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
urgenthuman	10	143.5	14.35
locatehuman	11	87.5	7.95
U		21.5	
U-prime		88.5	
Z		-2.36	p = .0183
Z corrected for ties		-2.39	p = .0167
# tied groups		5	

Task performance (human)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
urgenthuman	10	89	8.9
recordhuman	10	121	12.1
U	34		
U-prime	66		
Z	-1.21 p = .2265		
Z corrected for ties	-1.59 p = .1119		
* tied groups	1		

Task performance (synthesis)

Kruskal-Wallis X 1 : GROUP Y 1 : data

DF	2	
* Groups	3	
* Cases	27	
H	15.43	p = .0004
H corrected for ties	15.53	p = .0004
* tied groups	8	

Kruskal-Wallis X 1 : GROUP Y 1 : data

Group:	* Cases:	Σ Rank:	Mean Rank:
urgentcomputer	10	214.5	21.45
recordcomputer	10	115.5	11.55
locatecomputer	7	48	6.86

Task performance (synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
recordcomputer	10	108	10.8
locatecomputer	7	45	6.43
U		17	
U-prime		53	
Z		-1.76	p = .079
Z corrected for ties		-1.77	p = .077
# tied groups		5	

Task performance (synthesis)

Mann-Whitney U X ₁ : GROUP Y ₁ : data			
	Number:	Σ Rank:	Mean Rank:
urgentcomputer	10	147.5	14.75
recordcomputer	10	62.5	6.25

U	7.5	
U-prime	92.5	
Z	-3.21	p = .0013
Z corrected for ties	-3.23	p = .0012
* tied groups	6	

Task performance (synthesis)

Mann-Whitney U X ₁ : GROUP Y ₁ : data			
	Number:	Σ Rank:	Mean Rank:
urgentcomputer	10	122	12.2
locatecomputer	7	31	4.43
U		3	
U-prime		67	
Z		-3.12	p = .0018
Z corrected for ties		-3.13	p = .0017
* tied groups		5	

Recall performance for command/urgent/locate task

Kruskal-Wallis X₁ : GROUP Y₁ : data

DF	5	
* Groups	6	
* Cases	58	
H	12.8	p = .0254
H corrected for ties	17.3	p = .004
* tied groups	7	

Kruskal-Wallis X₁ : GROUP Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
urgenthuman	10	373	37.3
urgentcomputer	10	190	19
recordhuman	10	419	41.9
recordcomputer	10	267	26.7
locatehuman	11	298	27.09

Kruskal-Wallis X₁ : GROUP Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
locatecomputer	7	164	23.43

Recall performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
recordhuman	10	131	13.1
recordcomputer	10	79	7.9
U	24		
U-prime	76		
Z	-1.97		p = .0494
Z corrected for ties	-2.07		p = .0386
* tied groups	4		

Recall performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
urgenthuman	10	135	13.5
urgentcomputer	10	75	7.5
U		20	
U-prime		80	
Z		-2.27	p = .0233
Z corrected for ties		-2.8	p = .0051
# tied groups		4	

Recall performance (human vs synthesis)

Mann-Whitney U X 1 : GROUP Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
locatehuman	11	109	9.91
locatecomputer	7	62	8.86
U		34	
U-prime		43	
Z		-.41	p = .6836
Z corrected for ties		-.56	p = .5743
* tied groups		2	

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor will be able to detect variation in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will transmit information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to take the role of a member of supermarket control room staff. You will hear twenty seven spoken messages. Each message will consist of three words: the product container; the product; and the problem. These are listed in the vocabulary section, below.

You will listen to each message and then decide on your corrective action. After each message there will be a pause of ten seconds. In this time you will **write down the corrective action** that you believe to be appropriate to the message. Ten seconds is quite a short time so you will have to work quickly. If you do not know what to write, then draw a line (_____).

Vocabulary

Container

Bag
Bottle
Box

Jar
Loose
Packet

Shrinkwrapped
Tin
Wrapped

Product

Apple
Apple Sauce
Beef
Bread
Carrot
Celery
Chocolate
Corned Beef
Crumpets
Custard

Edam
Flour
Gateaux
Milk
Mop
Nuts
Oil
Pickles
Pork
Sam Smiths
Saucepan
Sausages

Sugar
Tomato
Washing Liquid

Problem

Misplaced
Dressing
Returns

Price
Low
Past Date

Empty
Spillage
Breakage

Corrective Action (in BOLD type)

Misplaced -- Replace
Dressing -- Tidy
Returns -- Reshelve

Price -- Check-price
Low -- Top-up
Past date -- Throw out

Empty -- Fill up
Spillage -- Mop up
Breakage -- Brush up

Corrective Task performance (human vs synthesis)

Mann-Whitney U X ₁ : Speech Y ₁ : Recall			
	Number:	Σ Rank:	Mean Rank:
human	34	1256	36.94
computer	20	229	11.45

U	19	
U-prime	661	
Z	-5.75	p = .0001
Z corrected for ties	-6.39	p = .0001
* tied groups	6	

Recall performance for corrective action task

Mann-Whitney U X ₁ : Speech Y ₁ : Recall			
	Number:	Σ Rank:	Mean Rank:
human	34	1040	30.59
computer	20	445	22.25

U	235	
U-prime	445	
Z	-1.88	p = .06
Z corrected for ties	-2.33	p = .0196
* tied groups	4	

Alarm Messages, for all three Alarm Conditions

- | | |
|-----------------------|------------------------------|
| 1. Tank 1 Empty; | 8. Condenser Empty; |
| 2. Tank 2 Empty; | 9. Product to Waste; |
| 3. Tank 3 Empty; | 10. Furnace Tripped; |
| 4. Tank 4 Empty; | 11. Boiler Temperature Low; |
| 5. Boiler Empty; | 12. Boiler Temperature High; |
| 6. Output Tank Empty; | 13. Pipe 4 Damaged; |
| 7. Output Tank Full. | |

Phonetic Alarm Messages

This gives the phonemes that were used to facilitate the most accurate sounding speech alarms.

- | | | |
|-----------------------------|---|---------------------------|
| 1. Tank 1 Empty | = | Taennk Wuhn Ehmptee |
| 2. Tank 2 Empty | = | Taennk T4ux Ehmptee |
| 3. Tank 3 Empty | = | Taennk Th2ree Ehmptee |
| 4. Tank 4 Empty | = | Taennk Fo4r Ehmptee |
| 5. Boiler Empty | = | Boyler Ehmptee |
| 6. Output Tank Full | = | Awtpuht Taennk Ful |
| 7. Output Tank Empty | = | Awtpuht Taennk Ehmptee |
| 8. Condenser Empty | = | K3ondehnser Ehmptee |
| 9. Product to Waste | = | Produlkt Tuw Wayst |
| 10. Furnace Tripped | = | Fernih4s Trihpp |
| 11. Boiler Temperature Low | = | Boyler Tehmper4cher Low2 |
| 12. Boiler Temperature High | = | Boyler Tehmper4cher Hiy2h |
| 13. Pipe 4 Damaged | = | Piyp Fo4r Daemaeg4d |

Numbers were used in conjunction with phonemes to improve the overall tone and sound of the synthesized word. A low number e.g. 1-3, forced the word to take on a low tone and a high number e.g. forced the word to take on a high tone and this precipitated a more comprehensive word/phase understanding.

The Training Video

Every subject was shown a ten minute training video, that the experimenter had developed to give the subject precise information on how to operate the simulator, and what the subjects objective in the experiment was.

The training video initially began with the experimenter informing the subject of the objective of the experiment. The experimenter proceeded to show the process plant screen and said

" The experiment you are going to take part in is concerned with operating a chemical processing plant, via a simulator on the computer. The objective of the experiment is to get as much yellow input liquid here (pointing to the yellow liquid on the screen), to green output, in the output tank, (and again the experimenter pointed to the output tank). To get the yellow liquid to green output you will need to open the valves on the pipes, here (pointed to the pipes), this will move the liquid to the boiler. As the liquid moves into the boiler it is then necessary to light the furnace and set the boiler temperature. When the boiler is set to the correct temperature (optimum temp 40 -60° C), the yellow liquid will turn red. When this occurs valves 7 and 8 can be opened, this allows coolant to flow through the condenser, which will facilitate your red liquid to go to green output, if you do not initiate this action the product will go to waste, so it is vital that you make this operation".

The experimenter then explained to the subjects the means by which they could control the process plant simulator. " The process plant can be operated by the F keys at the top of the keyboard (the experimenter points to the keys). As you can see, each F key has a precise operation, which is described on the template below the corresponding F key.

- F1: Open Valves 1-8:** therefore to open a valve press F1 and the number of the valve you want to open. Then press the **Return** key which will activate your operation.
- F2: Close Valve 1-8:** therefore to close a valve press F2 and the number of the valve you want to close. Then press the **Return** key which will activate your operation.
- F3: Light Furnace:** therefore to start the furnace up, light it by pressing F3 and then pressing the **Return** key which will again activate your operation.
- F4: Set Furnace Temperature:** 0=minimum heat to 4=maximum heat, therefore to set and reset the furnace temperature press F4 followed by the number (0-4 ie. what you want), then press **Return** to activate your operation.
- F5: Inspect Tank (1-4):** therefore to inspect a tank press F5 and then the number of the tank followed by the **Return** key to activate the operation.
- F6: Inspect Valve (1-8):** therefore to inspect a valve press F6 and then the number of the valve followed by the **Return** key to activate the operation.

- F7: Inspect Pipe (1-4):** therefore to inspect a pipe press **F7** and then the number of the pipe followed by the **Return** key to activate the operation.
- F8: Inspect Output Tank:** therefore to inspect the output tank, press **F8** followed by the **Return** key to activate the operation.
- F9: Inspect Boiler Level:** therefore to inspect the level of liquid in the boiler press **F9** followed by the **Return** key to activate the operation.
- F10: Inspect Boiler Temperature:** therefore to inspect the precise boiler temperature you will need to press **F10** followed by the **Return** key. It should be your intention to get the furnace to remain between 45°C - 60°C, which is when your yellow liquid will turn red and can then be processed further.
- F11: Inspect Furnace:** therefore to inspect the furnace level, press **F11**, followed by the **Return** key to activate the operation.
- F12: Start/Quit:** therefore to start or quit the simulator just press **F12**.

The simulator will at various times inform you of the process operations current state of affair via alarms. Therefore to accept these alarms you will need to press the **space bar** .

The experimenter then explained that the subject would also be required to attend to a secondary task whilst operating and monitoring the process plant. "In this little box here (point - bottom right hand side of the screen), you will find two little figures periodically come on to the screen. It is for you to determine if the figure on the right is the same as the figure on the left, when rotated. If the figure on the right is the same as the figure on the left, you will need to register your decision via the left-hand key on the mouse, which is labelled (YES). If the figure on the right, is not the same as the figure on the left when rotated you will need to press the right key on the mouse labelled (NO)". The experimenter then demonstrated this task to the subject.

The experimenter then gave a demonstration of how the process plant should be operated, this was facilitated by the experimenter informing the subject which keys she was pressing and for what reason, which was basically a reiteration of what was explained in the second paragraph.

The experiment devised and made three training videos, one for each of the three conditions;

1. Text Only;
2. Speech Only;
3. Speech and Text Only.

Each of the three training videos were exactly the same in content, apart from the alarm message communication medium. Therefore if a subject had been placed in the Speech and Text condition, then the training video was run on the simulator in this condition, so that training was a controlled variable.

Instructions Given to Each Subject before Experiment

Part 1:- Watching the Training Video

"I would like you to sit here and watch a 10 minute video. The video will inform you about the experiment you are going to take part in and then it will detail all the information you will need to know to operate and control the simulator. Do not worry about remembering every detail as you will be able to practise on the actual simulator, before the actual experiment begins. Therefore just familiarise yourself with the procedures and operations, Thank you."

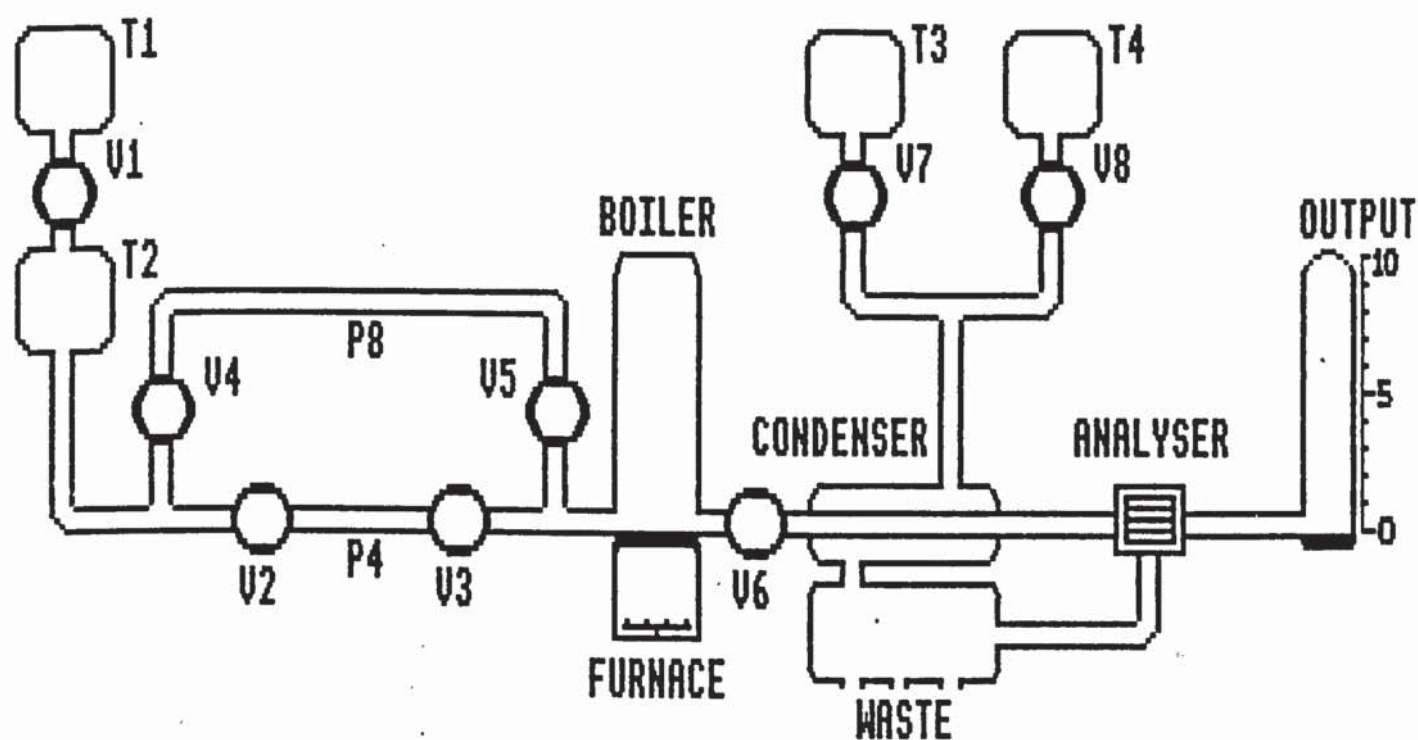
Part 2:- Practise Run(s)

"I now want you to run the simulator, to familiarise yourself with controlling the chemical plant, secondary spatial task and maximising output. As alarm messages are instigated it is important that you press the space bar."

When the subject had achieved a performance criterion level of 80%, the subject was allowed to move to the actual experiment.

Part 3:- Actual Experiment

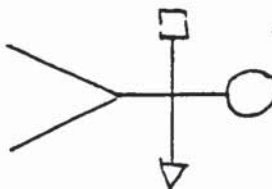
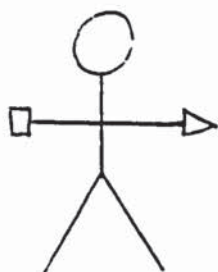
"I now want you to run the simulator again, but this time the screen will be masked and therefore you will not be able to constantly see the processes you are controlling. Instead you will be able to inspect individual plant components for a few seconds at a time by using the F5-F11 keys, as explained in the training program. Alarm messages will still be used by the system to help you control the plant, and once again these should be accepted by pressing the space bar. The secondary task will also be in operation so you are requested to attend to this task also, - Thank you."



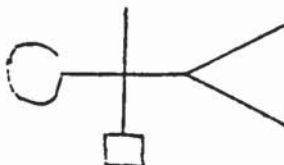
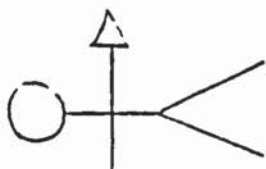
Secondary Spatial Task

The two diagrams below show the figures in different orientations, where one is correct when rotated, whilst the other is incorrect.

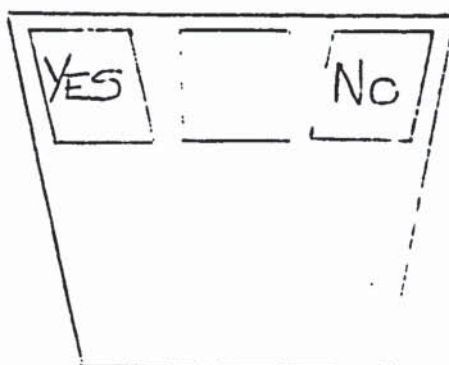
a. **Correct, (YES)**



b. **Incorrect, (NO)**



Subjects choice of correct was registered via a mouse. The left-hand button was labelled YES, i.e. figures were correct when rotated. The right-hand button of the mouse was labelled NO, i.e. figures were not the same when rotated.



output performance on process simulator

One Factor ANOVA X₁ : condition Y₁ : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	6842.85	3421.425	3.744
Within groups	27	24676.025	913.927	p = .0367
Total	29	31518.875		

Model II estimate of between component variance = 250.75

One Factor ANOVA X₁ : condition Y₁ : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	10	38.6	32.532	10.287
text	10	74.3	26.612	8.415
st	10	64.85	31.229	9.876

One Factor ANOVA X₁ : condition Y₁ : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	-35.7	27.74*	3.486*	2.641
speech vs. st	-26.25	27.74	1.885	1.942
text vs. st	9.45	27.74	.244	.699

* Significant at 95%

accept common alarms

One Factor ANOVA X 1 : condition Y 1 : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	659859779.565	329929889.783	7.418
Within groups	25	1.112E9	44478344.96	p = .003
Total	27	1.772E9		

Model II estimate of between component variance = 30740935.596

One Factor ANOVA X 1 : condition Y 1 : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	8	11678.075	12289.107	4344.855
text	10	293.97	202.755	64.117
st	10	1741.6	2459.304	777.7

One Factor ANOVA X 1 : condition Y 1 : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	11384.105	6515.316*	6.475*	3.599
speech vs. st	9936.475	6515.316*	4.933*	3.141
text vs. st	-1447.63	6142.699	.118	.485

* Significant at 95%

diagnose common alarms

One Factor ANOVA X 1 : condition Y 1 : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	101890125.867	50945062.933	1.794
Within groups	27	766907215.1	28403970.93	p = .1856
Total	29	868797340.967		

Model II estimate of between component variance = 2254109.2

One Factor ANOVA X 1 : condition Y 1 : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	10	7924.9	5729.671	1811.881
text	10	6469.3	3637.608	1150.313
st	10	10897.7	6257.043	1978.651

One Factor ANOVA X 1 : condition Y 1 : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	1455.6	4890.418	.186	.611
speech vs. st	-2972.8	4890.418	.778	1.247
text vs. st	-4428.4	4890.418	1.726	1.858

monitor common alarms

One Factor ANOVA X 1 : condition Y 1 : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	142192590.561	71096295.28	2.012
Within groups	27	953978117.489	35332522.87	p = .1533
Total	29	1096170708.05		

Model II estimate of between component variance = 3576377.241

One Factor ANOVA X 1 : condition Y 1 : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	10	11977.8	6817.755	2155.963
text	10	7736.69	4232.102	1338.308
st	10	12657	6450.202	2039.733

One Factor ANOVA X 1 : condition Y 1 : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	4241.11	5454.36	1.273	1.595
speech vs. st	-679.2	5454.36	.033	.256
text vs. st	-4920.31	5454.36	1.713	1.851

pipe 4 break accept

One Factor ANOVA X 1 : condition Y 1 : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	309917470.971	154958735.485	21.986
Within groups	24	169149704.214	7047904.342	p = .0001
Total	26	479067175.185		

Model II estimate of between component variance = 16639968.504

One Factor ANOVA X 1 : condition Y 1 : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	7	8736.429	5009.537	1893.427
text	10	668.3	570.844	180.517
st	10	1411.4	1318.424	416.922

One Factor ANOVA X 1 : condition Y 1 : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	8068.129	2700.187*	19.015*	6.167
speech vs. st	7325.029	2700.187*	15.674*	5.599
text vs. st	-743.1	2450.379	.196	.626

* Significant at 95%

pipe 4 break diagnosis

One Factor ANOVA X ₁ : condition Y ₁ : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	80942494.067	40471247.033	1.911
Within groups	27	571729069.4	21175150.719	p = .1674
Total	29	652671563.467		

Model II estimate of between component variance = 1929609.631

One Factor ANOVA X ₁ : condition Y ₁ : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	10	4701.4	7807.233	2468.864
text	10	1227.5	1484.599	469.472
st	10	1206.5	607.066	191.971

One Factor ANOVA X ₁ : condition Y ₁ : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	3473.9	4222.501	1.425	1.688
speech vs. st	3494.9	4222.501	1.442	1.698
text vs. st	21	4222.501	5.207E-5	.01

pipe 4 break monitor

One Factor ANOVA X 1 : condition Y 1 : data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	271540082.539	135770041.27	4.916
Within groups	25	690514368.175	27620574.727	p = .0158
Total	27	962054450.714		

Model II estimate of between component variance = 11646865.628

One Factor ANOVA X 1 : condition Y 1 : data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
speech	8	10857.875	9192.357	3249.989
text	10	4410.9	2752.113	870.295
st	10	3601.4	1851.463	585.484

One Factor ANOVA X 1 : condition Y 1 : data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
speech vs. text	6446.975	5134.256*	3.344	2.586
speech vs. st	7256.475	5134.256*	4.236*	2.911
text vs. st	809.5	4840.623	.059	.344

* Significant at 95%

in-appropriate actions

Kruskal-Wallis X₁ : condition Y₁ : data

DF	2	
* Groups	3	
* Cases	30	
H	8.578	p = .0137
H corrected for ties	8.661	p = .0132
* tied groups	6	

Kruskal-Wallis X₁ : condition Y₁ : data

Group:	* Cases:	Σ Rank:	Mean Rank:
speech	10	217	21.7
text	10	103	10.3
st	10	145	14.5

in-appropriate actions

Mann-Whitney U X 1 : condition Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
speech	10	139.5	13.95
text	10	70.5	7.05
U		15.5	
U-prime		84.5	
Z		-2.608	p = .0091
Z corrected for ties		-2.623	p = .0087
# tied groups		3	

in-appropriate actions

Mann-Whitney U X 1 : condition Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
speech st	10	132.5	13.25
	10	77.5	7.75
U		22.5	
U-prime		77.5	
Z		-2.079	p = .0376
Z corrected for ties		-2.087	p = .0368
* tied groups		5	

Mann-Whitney U X 1 : condition Y 1 : data			
	Number:	Σ Rank:	Mean Rank:
text	10	87.5	8.75
st	10	122.5	12.25
U		32.5	
U-prime		67.5	
Z		-1.323	p = .1859
Z corrected for ties		-1.338	p = .1809
# tied groups		5	

secondary task

Kruskal-Wallis X 1 : condition Y 1 : data

DF	2	
* Groups	3	
* Cases	30	
H	3.256	p = .1963
H corrected for ties	3.435	p = .1795
* tied groups	6	

Kruskal-Wallis X 1 : condition Y 1 : data

Group:	* Cases:	Σ Rank:	Mean Rank:
speech	10	116.5	11.65
text	10	186.5	18.65
st	10	162	16.2

secondary task correct

Kruskal-Wallis X 1 : condition Y 1 : data

DF	2
* Groups	3
* Cases	30
H	1.634 p = .4419
H corrected for ties	1.637 p = .4411
* tied groups	7

Kruskal-Wallis X 1 : condition Y 1 : data

Group:	* Cases:	Σ Rank:	Mean Rank:
speech	10	126	12.6
text	10	171	17.1
st	10	168	16.8

recall performance on process simulator

Kruskal-Wallis X₁ : condition Y₁ : recall

DF	2
* Groups	3
* Cases	30
H	11.228 p = .0036
H corrected for ties	11.571 p = .0031
* tied groups	7

Kruskal-Wallis X₁ : condition Y₁ : recall

Group:	* Cases:	Σ Rank:	Mean Rank:
speech	10	80	8
text	10	204	20.4
st	10	181	18.1

Mann-Whitney U X ₁ : condition Y ₁ : recall			
	Number:	Σ Rank:	Mean Rank:
text st	10	111	11.1
	10	99	9.9
U		44	
U-prime		56	
Z		-.454	p = .6501
Z corrected for ties		-.467	p = .6406
* tied groups		5	

recall performance on process simulator

Mann-Whitney U X ₁ : condition Y ₁ : recall			
	Number:	Σ Rank:	Mean Rank:
speech	10	73	7.3
st	10	137	13.7
U		18	
U-prime		82	
Z		-2.419	p = .0156
Z corrected for ties		-2.453	p = .0142
* tied groups		6	

recall performance on process simulator

Mann-Whitney U X ₁ : condition Y ₁ : recall			
	Number:	Σ Rank:	Mean Rank:
speech	10	62	6.2
text	10	148	14.8
U		7	
U-prime		93	
Z		-3.25	p = .0012
Z corrected for ties		-3.294	p = .001
# tied groups		7	

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record the order in which they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

Alarm Listing:

- 1 Bag Bread Breakage**
- 2 Bag Flour Low**
- 3 Bag Sugar Low**
- 4 Bottle Milk Return**
- 5 Bottle Sam Smiths Breakage**
- 6 Bottle Washing Liquid Empty**
- 7 Box Chocolate Breakage**
- 8 Box Custard Return**
- 9 Box Saucepan Price**
- 10 Jar Apple Sauce Dressing**
- 11 Jar Oil Misplaced**
- 12 Jar Pickles Spillage**
- 13 Loose Apple Misplaced**
- 14 Loose Carrot Empty**
- 15 Loose Mop Return**
- 16 Packet Crumpets Low**
- 17 Packet Gateaux Spillage**
- 18 Packets Nuts Price**
- 19 Shrinkwrap Beef Price**
- 20 Shrinkwrap Edam Past Date**
- 21 Shrinkwrap Pork Past Date**
- 22 Tin Corned Beef Misplaced**
- 23 Tin Sausages Spillage**
- 24 Tin Tomato Empty**
- 25 Wrapped Celery Past Date**
- 26 Wrapped Sausages Dressing**
- 27 Wrapped Tomato Dressing**

ORDER OF PRESENTATION

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.
- 24.
- 25.
- 26.
- 27.

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record this on the location where they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record the order in which they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

Alarm Listing:

- 1 Bag Bread Breakage**
- 2 Bag Flour Low**
- 3 Bag Sugar Low**
- 4 Bottle Milk Return**
- 5 Bottle Sam Smiths Breakage**
- 6 Bottle Washing Liquid Empty**
- 7 Box Chocolate Breakage**
- 8 Box Custard Return**
- 9 Box Saucepan Price**
- 10 Jar Apple Sauce Dressing**
- 11 Jar Oil Misplaced**
- 12 Jar Pickles Spillage**
- 13 Loose Apple Misplaced**
- 14 Loose Carrot Empty**
- 15 Loose Mop Return**
- 16 Packet Crumpets Low**
- 17 Packet Gateaux Spillage**
- 18 Packets Nuts Price**
- 19 Shrinkwrap Beef Price**
- 20 Shrinkwrap Edam Past Date**
- 21 Shrinkwrap Pork Past Date**
- 22 Tin Corned Beef Misplaced**
- 23 Tin Sausages Spillage**
- 24 Tin Tomato Empty**
- 25 Wrapped Celery Past Date**
- 26 Wrapped Sausages Dressing**
- 27 Wrapped Tomato Dressing**

Salad

Vegetables

Fruit

Tinned Food

Cooking Products

Non Food

Frozen Food

Bakery

Dairy Products

Beers,
Wines,
and
Spirits

Butcher

Checkouts

○ ○ ○ ○ ○

T / A / M Sub no. ____ O / L / P

Introduction

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You are required to read the message(s) and note down the corresponding pattern of alarm messages.

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- 1 Bag Bread Breakage**
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- 3 Bag Sugar Low**
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- 7 Box Chocolate Breakage**
- 8 Box Custard Return**
- 9 Box Saucepan Price**
- 10 Jar Apple Sauce Dressing**
- 11 Jar Oil Misplaced**
- 12 Jar Pickles Spillage**
- 13 Loose Apple Misplaced**
- 14 Loose Carrot Empty**
- 15 Loose Mop Return**
- 16 Packet Crumpets Low**
- 17 Packet Gateaux Spillage**
- 18 Packets Nuts Price**
- 19 Shrinkwrap Beef Price**
- 20 Shrinkwrap Edam Past Date**
- 21 Shrinkwrap Pork Past Date**
- 22 Tin Corned Beef Misplaced**
- 23 Tin Sausages Spillage**
- 24 Tin Tomato Empty**
- 25 Wrapped Celery Past Date**
- 26 Wrapped Sausages Dressing**
- 27 Wrapped Tomato Dressing**

Bottle Washing Liquid Empty

Loose Carrot Empty

Loose Apple Mispaced

Packot Crumpets Low

Jar Oil Mispaced

Shrinkwrap Beef Price

Bag Flour Low

Wrapped Tomato Dressing

Shrinkwrap Edam Past Date

Shrinkwrap Pork Past Date

Packot Nuts Price

Loose Map Return

Tin Corned Beef Mispaced

Tin Tomato Empty

Bottle Sam Smiths Breakage

Loose Carrot Empty

Shrinkwrap Pork Peel Date
Tin Tomato Empty

Bottle Washing Liquid Empty
Bag Flour Low

Jar Pickles Spillage
Shrinkwrap Pork Peel Date

Wrapped Sausages Dressing
Bottle Washing Liquid Empty

Shrinkwrap Edam Peel Date
Bottle Washing Liquid Empty

Jar Pickles Spillage
Shrinkwrap Pork Peel Date

Jar Pickles Spillage
Wrapped Sausages Dressing

Box Custard Return
Bottle Washing Liquid Empty

Shrinkwrap Pork Peel Date
Bottle Washing Liquid Empty

Bottle Washing Liquid Empty
Wrapped Tomato Dressing

Jar Pickles Spillage
Jar Oil Mispaced

Tin Tomato Empty
Wrapped Sausages Dressing

Shrinkwrap Edam Peel Date
Tin Tomato Empty

Bottle Washing Liquid Empty
Jar Apple Sauce Dressing

Bottle Washing Liquid Empty
Wrapped Sausages Dressing

Shrinkwrap Pork Peel Date
Loose Carrot Empty

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Jar Pickles Spillage
Shrinkwrap Pork Pool Date

Wrapped Celery Pool Date
Peach Crumpets Low
Bottle Washing Liquid Empty
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Box Chocolate Breakage
Peach Crumpets Low

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Peach Crumpets Low
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Tin Sausages Spillage
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Jar Pickles Spillage
Box Chocolate Breakage
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Box Chocolate Breakage
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Peach Crumpets Low
Box Chocolate Breakage
Shrinkwrap Pork Pool Date

Wrapped Celery Pool Date
Peach Nuts Price
Loose Carrot Empty
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Peach Crumpets Low
Jar Pickles Spillage
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Jar Pickles Spillage
Peach Crumpets Low

Wrapped Celery Pool Date
Peach Crumpets Low
Jar Pickles Spillage
Shrinkwrap Edam Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Bag Bread Breakage
Shrinkwrap Pork Pool Date

Wrapped Celery Pool Date
Peach Crumpets Low
Box Chocolate Breakage
Shrinkwrap Pork Pool Date

Bottle Washing Liquid Empty
Wrapped Celery Pool Date
Box Chocolate Breakage
Peach Crumpets Low

Box Chocolate Breakage
Peach Crumpets Low
Jar Pickles Spillage
Shrinkwrap Pork Pool Date

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Jar Pickles Spillage
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Bag Bread Breakage
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Nuts Price
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Pockel Nuts Price
Wrapped Celery Past Date
Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Bag Flour Low

Pockel Nuts Price
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Tin Sausages Spillage
Loose Carrot Empty
Pockel Crumpets Low
Jar Apple Sauce Dressing
Bag Flour Low

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Box Custard Return
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Wrapped Celery Past Date
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Box Custard Return
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Pockel Nuts Price
Wrapped Celery Past Date
Tin Corned Beef Mispaced
Tin Sausages Spillage
Loose Carrot Empty
Bag Bread Breakage
Jar Apple Sauce Dressing
Bag Flour Low

Box Chocolate Breakage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Shrinkwrap Beef Price
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Bag Sugar Low
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Pockel Nuts Price
Shrinkwrap Edam Past Date
Wrapped Sausages Dressing
Pockel Gâteaux Spillage
Loose Carrot Empty
Tin Corned Beef Mispaced
Jar Apple Sauce Dressing
Bag Sugar Low

Pockel Nuts Price
Wrapped Celery Past Date
Wrapped Sausages Dressing
Pockel Gâteaux Spillage
Loose Carrot Empty
Bag Bread Breakage
Jar Apple Sauce Dressing
Bag Sugar Low

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Shrinkwrap Edam Past Date
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Tin Sausages Spillage
Jar Apple Sauce Dressing
Pockel Crumpets Low
Bag Bread Breakage
Tin Corned Beef Mispaced
Bag Flour Low
Tin Tomato Empty
Bottle Washing Liquid Empty

Bottle Sam Smiths Breakeage
Box Custard Return
Jar Pickles Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Bag Flour Low
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Wrapped Tomato Dressing
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Loose Carrot Empty
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Shrinkwrap Beef Price
Wrapped Celery Post Date
Bag Flour Low
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Box Chocolate Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Jar Apple Sauce Dressing
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Bag Flour Low
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Peachel Crumpets Low
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Tin Tomato Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Jar Pickles Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Bag Sugar Low
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Bag Sugar Low
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Bag Flour Low
Bottle Milk Return

Bottle Sam Smiths Breakeage
Box Custard Return
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Box Saucespan Price
Shrinkwrap Pork Post Date
Bottle Milk Return

Bottle Sam Smiths Breakeage
Jar Apple Sauce Dressing
Peachel Goleaux Spillage
Bag Bread Breakeage
Jar Oil Mispaced
Loose Apple Return
Bottle Washing Liquid Empty
Wrapped Celery Post Date
Shrinkwrap Pork Post Date
Bottle Milk Return

Petal Gateaux Spillage
 Jar Apple Sauce Dripping
 Petal Nuts Price
 Loose Carrot Empty
 Loose Map Return
 Jar Oil Mispaced
 Bottle Washing Liquid Empty
 Loose Apple Mispaced
 Box Chocolate Breathe
 Jar Pickles Spillage
 Tin Sauces Spillage
 Bag Flour Low
 Box Cusard Empty
 Bag Bread Breathe
 Bottle Milk Return

Product Goleaux Spillage
 Jar Apple Sauce Drowning
 Bag Sugar Low
 Loose Carrot Empty
 Loose Map Return
 Jar Oil Mispaced
 Bottle Washing Liquid Empty
 Wrapped Tomato Drowning
 Box Chocolate Breackage
 Jar Pickles Spillage
 Tin Sausages Spillage
 Bag Flour Low
 Box Mustard Empty
 Bag Bread Breackage
 Bottle Milk Return

Peach Salsa Spillage
 Jar Apple Sauce Dressing
 Box Sauceman Price
 Loose Carrot Empty
 Loose Map Return
 Jar Oil Impaled
 Bottle Washing Liquid Empty
 Loose Apple Impaled
 Box Chocolate Brokeage
 Jar Pickles Spillage
 Tin Souvenage Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Brokeage
 Bottle Milk Return

Wrapped Tomato Dressing
 Jar Apple Sauce Dressing
 Potato Crumpets Low
 Loose Corral Empty
 Loose Nap Return
 Jar Off Napused
 Bottle Washing Liquid Empty
 Loose Apple Napused
 Box Chocolate Brunches
 Jar Pickles Spillings
 Tin Sausages Spillings
 Bag Flour Low
 Box Oatmeal Empty
 Bag Bread Brunches
 Bottle Milk Return

Packet Gaiexox Spillage
 Jar Apple Sauce Dressing
 Package Crumpets Low
 Loose Correl Empty
 Loose Map Return
 Jar Oil Unplanned
 Bottle Washing Liquid Empty
 Wrapped Tomato Dressing
 Box Chocolate Breading
 Jar Pickles Spillage
 Tin Sausages Spillage
 Bag Flour Low
 Box Cusard Empty
 Bag Bread Breading
 Bottle Milk Return

Pocket Gopher Springs
 Jar Apple Sauce Dressing
 Pickles Crumpets Low
 Loose Carrot Empty
 Loose Map Return
 Jar Oil Mismatched
 Bottle Washing Liquid Empty
 Loose Apple Mismatched
 Box Chocolate Broomage
 Jar Pickles Springs
 Tin Sausages Springs
 Shrinkwrap Pork Feet Date
 Box Custard Empty
 Bag Bread Broomage
 Bottle Milk Return

Pocket Goleaux Spillage
 Jar Apple Sauce Dressing
 Bag Sugar Low
 Loose Carrot Empty
 Loose Map Return
 Jar Oil Missplaced
 Bottle Washing Liquid Empty
 Loose Apple Missplaced
 Box Chocolate Brokeage
 Jar Pinkies Spillage
 Tin Sauces Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Brokeage
 Bottle Milk Return

Potato Grains Spillage
 Jar Apple Sauce Drowning
 Potato Crumpets Low
 Loose Carrot Empty
 Loose Map Return
 Wrapped Sausages Drowning
 Bottle Washing Liquid Empty
 Loose Apple Mispaced
 Box Chocolate Brackets
 Jar Pickles Spillage
 Tin Sausages Spillage
 Bag Flour Low
 Box Cucumber Empty
 Bag Bread Brackets
 Bottle Milk Return

Peach Gleaux Spillage
 Jar Apple Sauce Drowning
 Peaches Crumpled Low
 Loose Corral Empty
 Loose Map Return
 Jar Oil Mispaced
 Bottle Washing Liquid Empty
 Loose Apple Mispaced
 Box Chocolate Bratage
 Jar Pickles Spillage
 Tin Sauces Spillage
 Shrinkwrap Park Feed Date
 Box Custard Empty
 Bag Bread Bratage
 Bottle Milk Return

Pocket Solitaire Spillage
 Jar Apple Sauce Dressing
 Pasta Crumpets Low
 Bottle Soda Smiths Brochure
 Loose Map Return
 Jar Oil Mislabeled
 Bottle Washing Liquid Empty
 Loose Apple Mislabeled
 Box Chocolate Brochure
 Jar Pickles Spillage
 Tin Sauces Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Brochure
 Bottle Milk Return

Pickles Goleaux Spillage
Jar Apple Sauce Dressing
Pickles Crumpets Low
Lease Carrot Empty
Lease Map Return
Jar Oil Blimped
Bottle Washing Liquid Empty
Lease Apple Blimped
Box Chocolate Broilage
Jar Pickles Spillage
Tin Soupsage Spillage
Bag Flour Low
Box Custard Empty
Bag Bread Broilage
Bottle Milk Return

Peachel Salsaur Spillage
 Jar Apple Sauce Drowning
 Peachies Crumpets Low
 Lemon Carrot Empty
 Shrikurpur Park Price
 Jar Oil Misplaced
 Bottle Washing Liquid Empty
 Lemon Apple Misplaced
 Box Chocolate Brunchage
 Jar Pickles Spillage
 Tin Sausages Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Brunchage
 Bottle Milk Return

Pocket Gelsolin Spillage
 Jar Apple Sauce Drowning
 Pocket Nuts Price
 Loose Carrot Empty
 Loose Nap Return
 Jar Oil Mismatched
 Bottle Washing Liquid Empty
 Loose Apple Mismatched
 Box Chocolate Breakage
 Jar Pickles Spillage
 Tin Sausages Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Breakage
 Bottle Milk Return

Peelot Gelcoat Spillage
Jar Apple Sauce Drowning
Peelot Crumpets Low
Lease Carrot Empty
Lease Map Return
Tin Corned Beef Mismatched
Bottle Washing Liquid Empty
Lease Apple Mismatched
Box Chocolate Brokeage
Jar Pickles Spillage
Tin Sausages Spillage
Bag Flour Low
Box Custard Empty
Bag Bread Brokeage
Bottle Milk Return

Peckst Gateaux Spillage
Jar Apple Sauce Dressing
Peckst Crumpets Low
Lease Carrot Empty
Lease Map Return
Box Sausages Price
Bottle Washing Liquid Empty
Lease Apple Mismatched
Box Chocolate Breakage
Jar Pickles Spillage
Tin Sausages Spillage
Bag Flour Low
Box Custard Empty
Bag Bread Breakage
Bottle Milk Return

Potato Gatox Spillage
 Jer Apple Sauce Dressing
 Potato Nutz Price
 Loose Carrot Empty
 Loose Map Return
 Jer Oil Mispaced
 Bottle Washing Liquid Empty
 Tin Corned Beef Mispaced
 Box Chocolate Bruchage
 Jer Pickles Spillage
 The Sauces Spillage
 Bag Flour Low
 Box Custard Empty
 Bag Bread Bruchage
 Bottle Milk Spillage

Jar Oils Mismatched
 Jar Apple Sauce Dressing
 Box Chocolate Breadcrumbs
 Box Custard Return
 Loose Apple Mismatched
 Tin Sausages Spillage
 Bottle Milt Return
 Shrimpsurp Eden Post Date
 Jar Pickles Spillage
 Packet Gelatin Spillage
 Loose Carrot Empty
 Packet Cornstarch Low
 Bag Sugar Breadcrumbs
 Loose Beef Return
 Wrapped Celery Post Date
 Shrimpsurp Pork Post Date
 Bottle Washing Liquid Empty
 Bag Flour Low
 Packet Nuts Price
 Shrimpsurp Beef Price

Jar Of Misploed
 Jar Apple Sauce Dressing
 Box Chocolate Biscuits
 Box Custard Return
 Loose Apple Misploed
 The Sausages Spillage
 Bottle Milk Return
 Shrimpsoup Edom Post Date
 Jar Pickles Spillage
 Packet Goleaux Spillage
 Loose Carrot Empty
 Packet Crumpets Low
 Bag Bread Breakage
 Loose Map Return
 Wrapped Celery Past Date
 Shrimpsoup Port Past Date
 Bottle Washing Liquid Empty
 Box Sausages Price
 Wrapped Sausages Dressing
 Shrimpsoup Port Past Date

Jar Off Mismatched
 Jar Apple Sauce Dressing
 Box Chocolate Brokeage
 Box Custard Return
 Loose Apple Mismatched
 The Sausages Spillage
 Bottle Milk Return
 Shrinkwrap Eaten Post Date
 Jar Pickles Spillage
 Potato Gelatin Spillage
 Loose Carrot Empty
 Potato Crumpets Low
 Bag Bread Brokeage
 Bottle Bread Smiths Brokeage
 Wrapped Colory Post Date
 Shrinkwrap Pork Post Date
 Bottle Washing Liquid Empty
 Bag Flour Low
 Wrapped Sausages Dressing

Jar On Mismatched
 Jar Apple Sauce Dressing
 Box Chocolate Breakage
 Box Custard Return
 Packet Nuts Ripe
 Tin Sausages Spillage
 Bottle Milk Return
 Shrinkwrap Eggs Past Date
 Jar Pinkies Spillage
 Packet Gateaux Spillage
 Loose Carrot Empty
 Packet Crumpets Low
 Bag Bread Breakage
 Loose Nap Return
 Wrapped Celery Past Date
 Shrinkwrap Pork Past Date
 Bottle Washing Liquid Empty
 Bag Flour Low
 Wrapped Sausages Dressing

Best Oatmeal Return
 Peaches Nuts Price
 Jar Of Mince
 Shortcrust Beef Price
 Wrapped Tomato Dressing
 Loose Curry Empty
 Wrapped Celery Past Date
 Bag Bread Broomage
 Wrapped Sausages Dressing
 Potato Goulash Spillage
 Shortcrust Past Past Date
 Sausages Price
 Tin Tomato Empty
 Bottle Bean Smiths Broomage
 Peaked Crumpets Low
 Bottle Milk Return
 Tin Sausages Spillage
 Loose Apple Mince
 Bag Sugar Low
 Jar Pickles Spillage
 Jar Apple Sauce Overweight
 Bag Flour Low
 Loose Beef Return
 Best Chocolate Broomage
 Shortcrust Edam Past Date

Box Corned Roast
Peasable Nuts Price
Tin Corned Beef Shipboard
Shrinkwrap Beef Price
Wrapped Tomato Dressing
Bottle Washing Liquid Empty
Wrapped Celery Past Date
Bag Bread Breakage
Wrapped Sausages Dressing
Loose Carrot Empty
Shrinkwrap Pork Past Date
Box Sausages Price
Tin Tomato Empty
Bottle Sea Smother Breakage
Peeled Crumpets Low
Bottle Split Return
Tin Apples Sausage
Loose Apples Shipboard
Bag Sugar Low
Jar Pickles Splitting
Jar Apples Sausage Dressing
Bag Flour Low
Loose Map Return
Box Chocolate Breakage
Shrinkwrap Edam Past Date

Best Corned Beef
 Peaches Nuts Pine
 Jar Of Marmalade
 Shrimps/ur Beef Prime
 Wrapped Tomato Dressing
 Bottle Washing Liquid Empty
 Wrapped Celery Past Date
 Bag Good Brothage
 Wrapped Sausages Opening
 Packet Genuin Spillage
 Shrimps/ur Pork Past Date
 Box Sausages Prime
 Tin Tomato Empty
 Bottle Sea Smiths Brothage
 Packet Crumpets Low
 Bottle Milk Future
 Tin Sausages Spillage
 Loose Apple Minceed Bag
 Bag Sugar Low
 Loose Cornet Empty
 Jar Apple Sauce Dressing
 Bag Flour Low
 Loose Map Return
 Best Cheesecake Brothage
 Shrimps/ur Edam Past Date

Best Cusiner Return
Lemon Cornet Empty
Tin Corned Beef Blimphead
Shrimprun Best Price
Wrapped Tomato Dressing
Bottle Washing Liquid Empty
Wrapped Cotery Past Date
Bag Bread Brokeage
Wrapped Sausages Dressing
Porket Goleaux Spillage
Shrimprun Park Past Date
Bar Sausages Price
Tin Tomato Empty
Bottle Sam Smutis Brokeage
Porket Crumpets Low
Bottle Milk Return
Tin Sausages Spillage
Lemon Apple Blimphead
Bag Sugar Low
Jer Potatoes Spillage
Jer Apple Sauce Dressing
Bag Sugar Low
Lemon May Return
Best Chocolate Brokeage
Shrimprun, Rdwn, Past Date

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record the order in which they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)



1. Bag _ Breakage



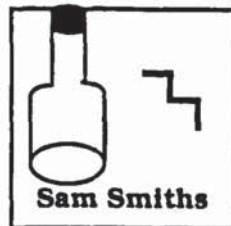
2. Bag _ Low



3. Bag _ Low



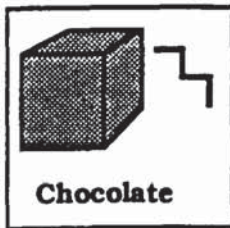
4. Bottle _ Return



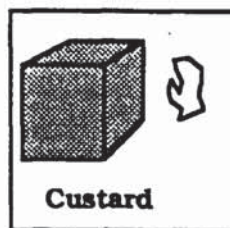
5. Bottle _ Breakage



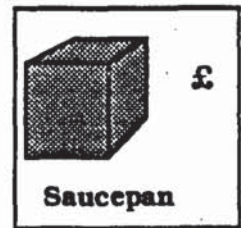
6. Bottle _ Empty



7. Box _ Breakage



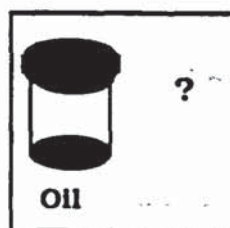
8. Box _ Return



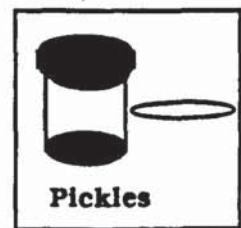
9. Box _ Price



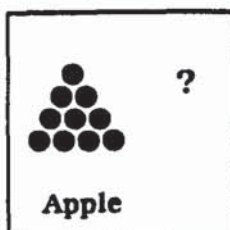
10. Jar _ Dressing



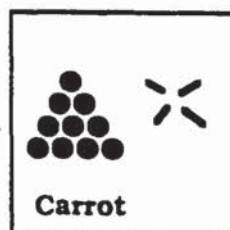
11. Jar _ Misplaced



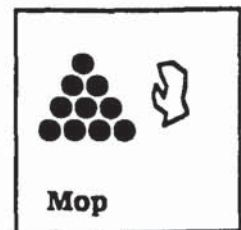
12. Jar _ Spillage



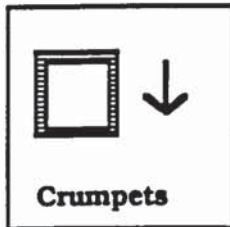
13. Loose _ Misplaced



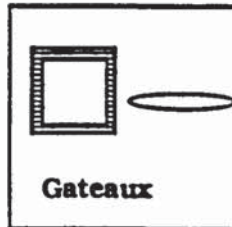
14. Loose _ Empty



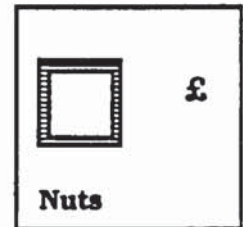
15. Loose _ Return



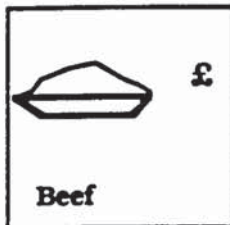
16. Packet _ Return



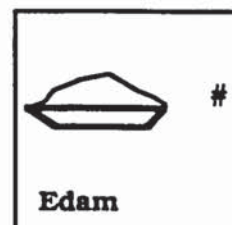
17. Packet _ Spillage



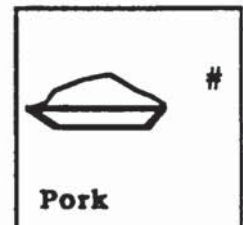
18. Packet _ Price



19. Shrinkwrap _ Price



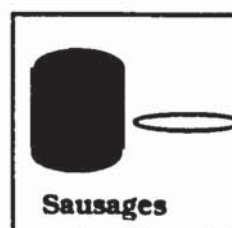
20. Shrinkwrap _ Past Date



21. Shrinkwrap _ Past Date



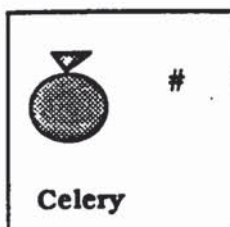
22. Tin _ Misplaced



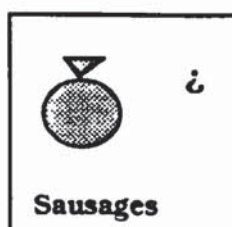
23. Tin _ Spillage



24. Tin _ Empty



25. Wrapped _ Past Date



26. Wrapped _ Dressing



27. Wrapped _ Dressing

ORDER OF PRESENTATION

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.
- 24.
- 25.
- 26.
- 27.

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record this on the location where they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)



1. Bag _ Breakage



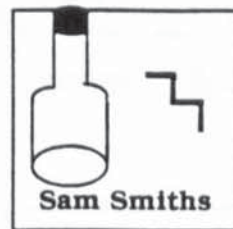
2. Bag _ Low



3. Bag _ Low



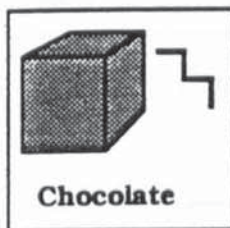
4. Bottle _ Return



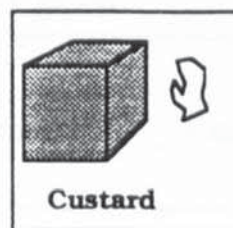
5. Bottle _ Breakage



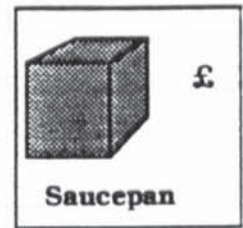
6. Bottle _ Empty



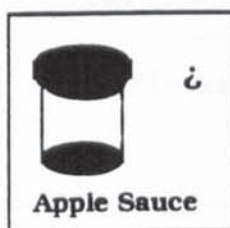
7. Box _ Breakage



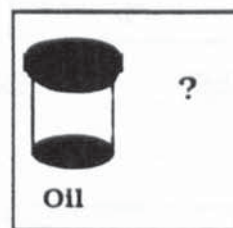
8. Box _ Return



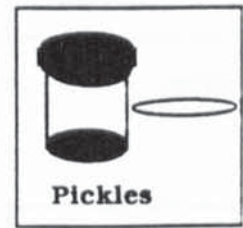
9. Box _ Price



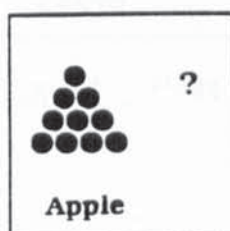
10. Jar _ Dressing



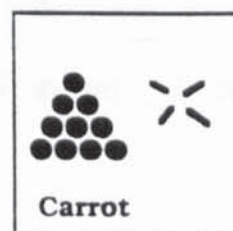
11. Jar _ Misplaced



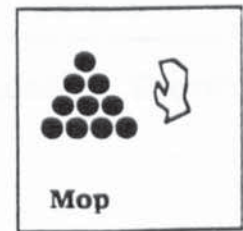
12. Jar _ Spillage



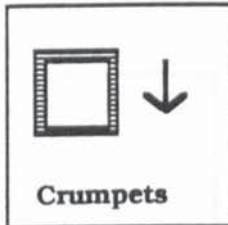
13. Loose _ Misplaced



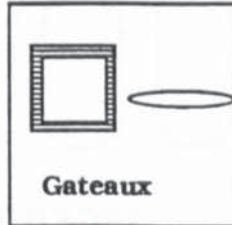
14. Loose _ Empty



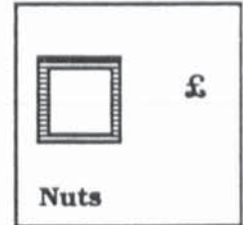
15. Loose _ Return



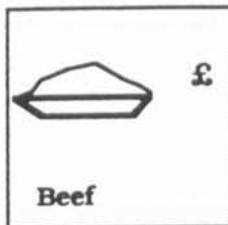
16. Packet _ Return



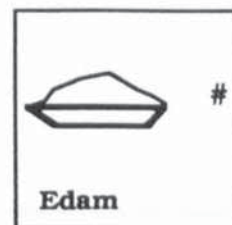
17. Packet _ Spillage



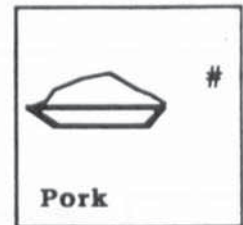
18. Packet _ Price



19. Shrinkwrap _ Price



20. Shrinkwrap _ Past Date



21. Shrinkwrap _ Past Date



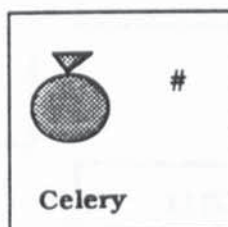
22. Tin _ Misplaced



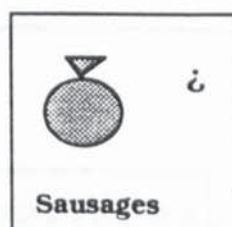
23. Tin _ Spillage



24. Tin _ Empty



25. Wrapped _ Past Date



26. Wrapped _ Dressing



27. Wrapped _ Dressing

Butcher

Checkouts

Beers,
Wines,
and
Spirits

Dairy Products

Frozen Food

Non Food

Cooking Products

Bakery

Tinned Food

Fruit

Vegetables

Salad

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

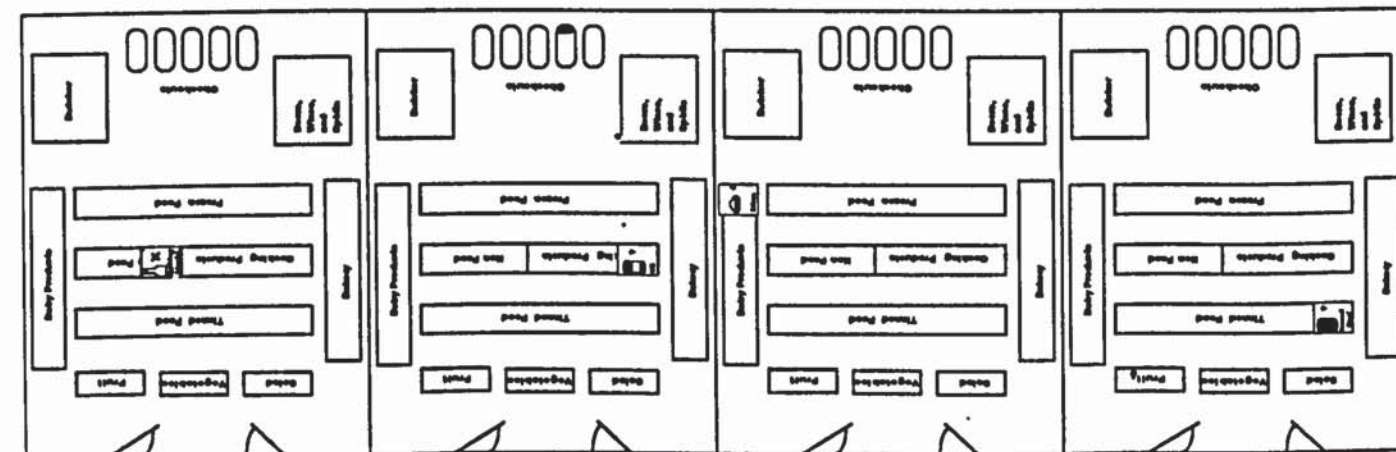
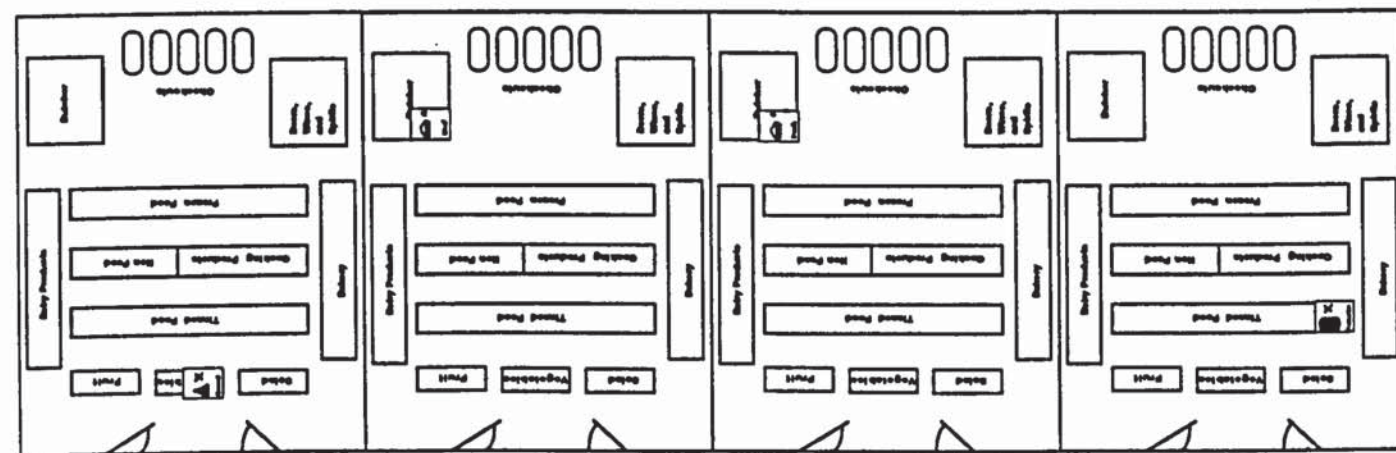
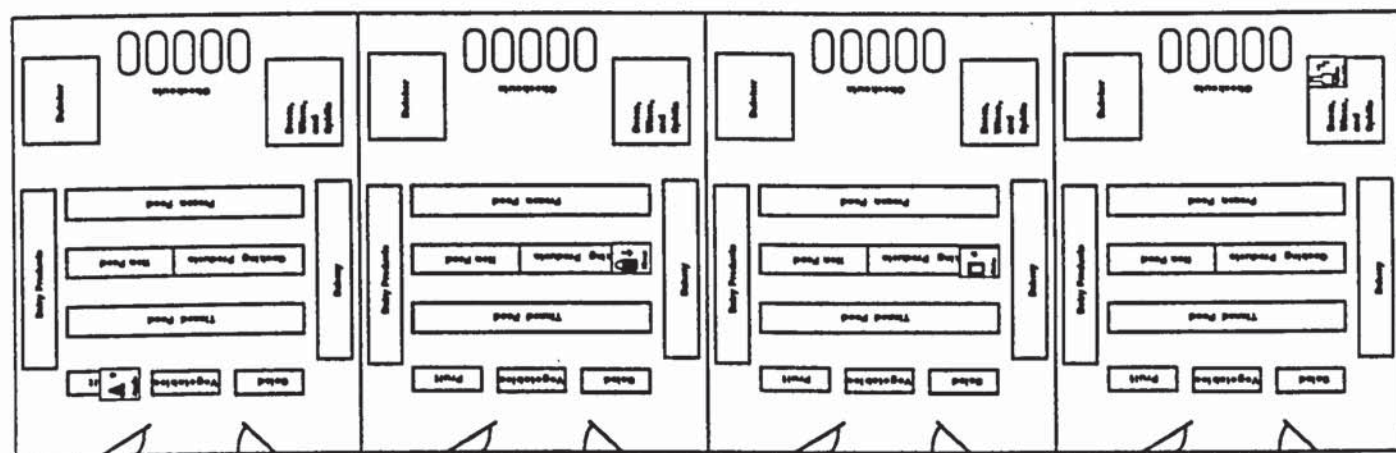
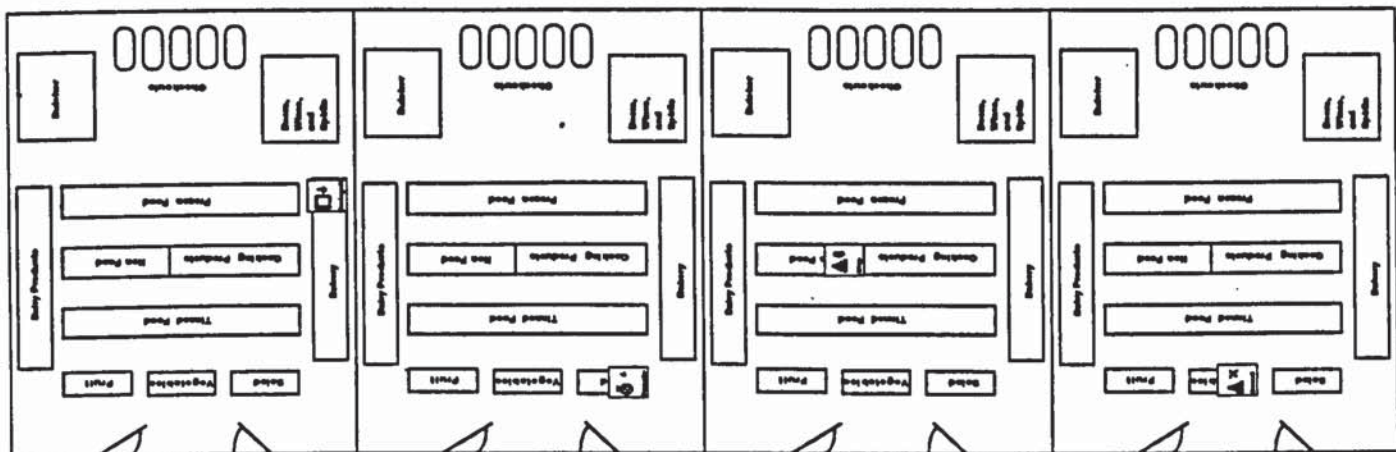
In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

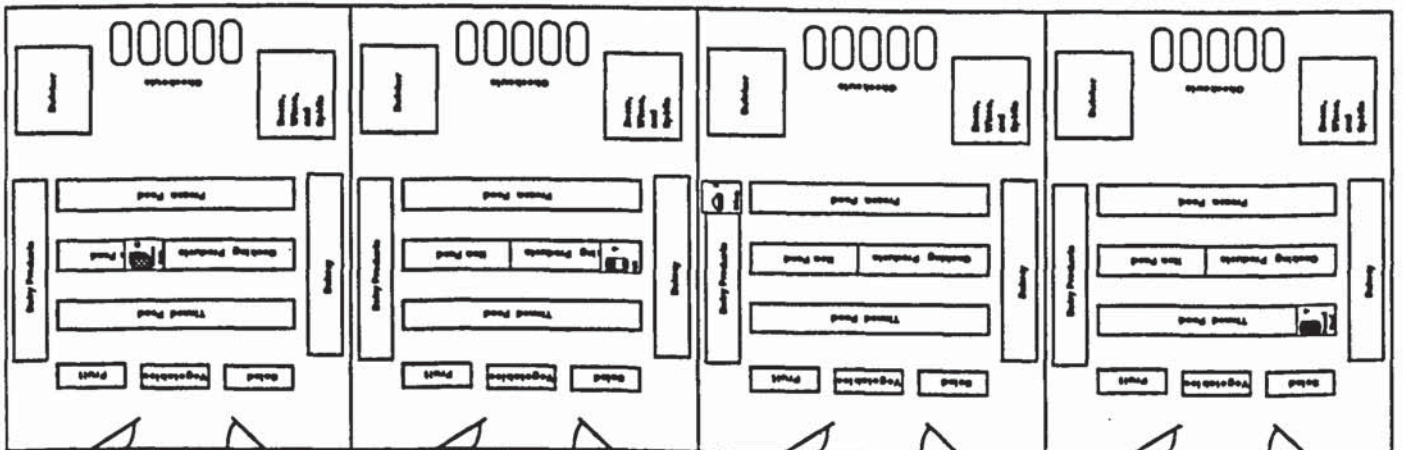
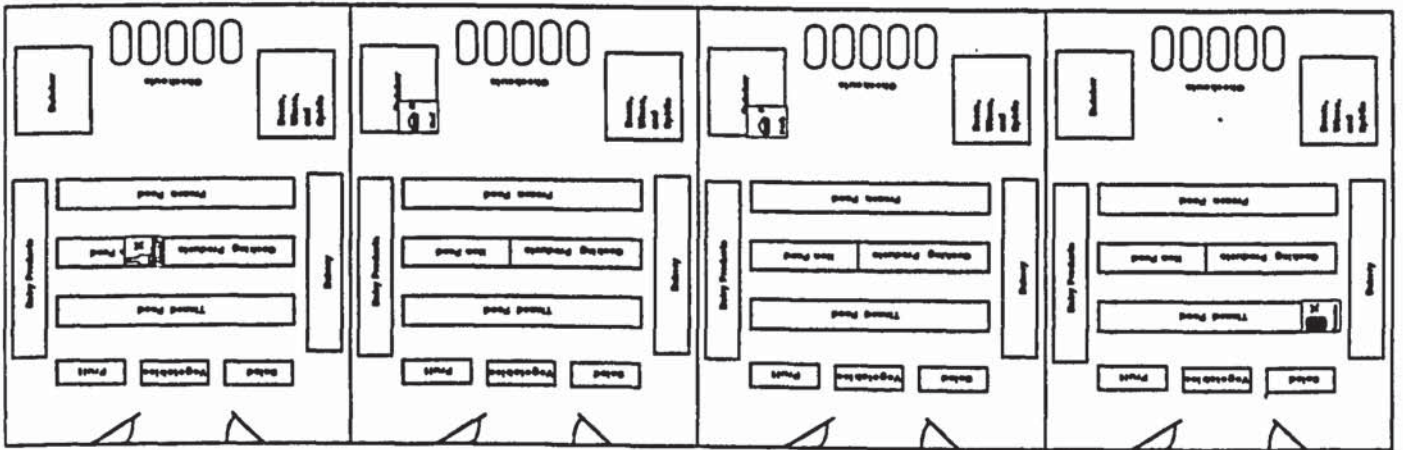
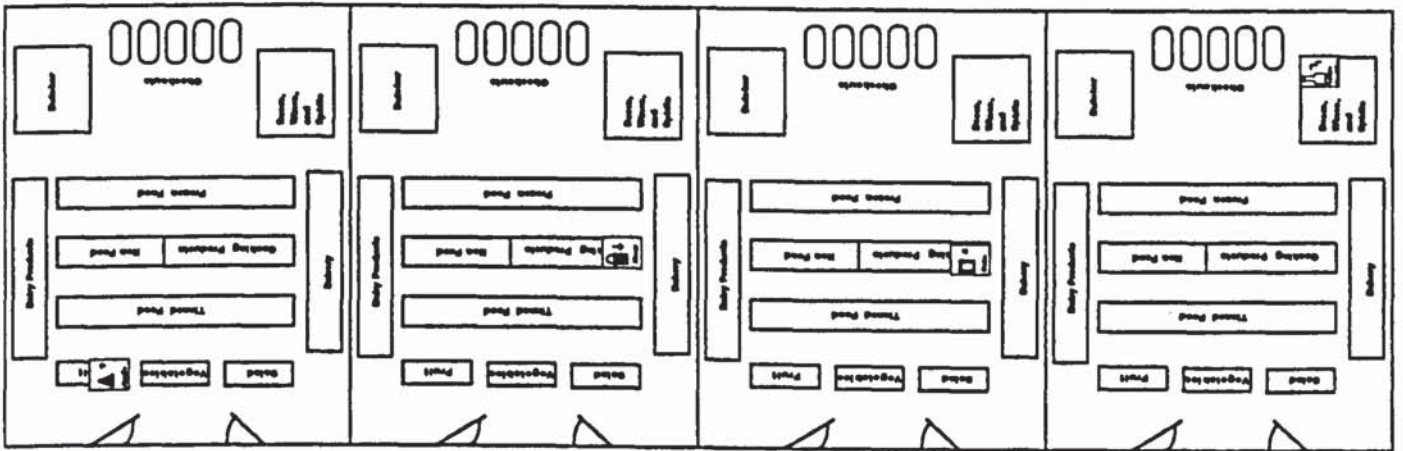
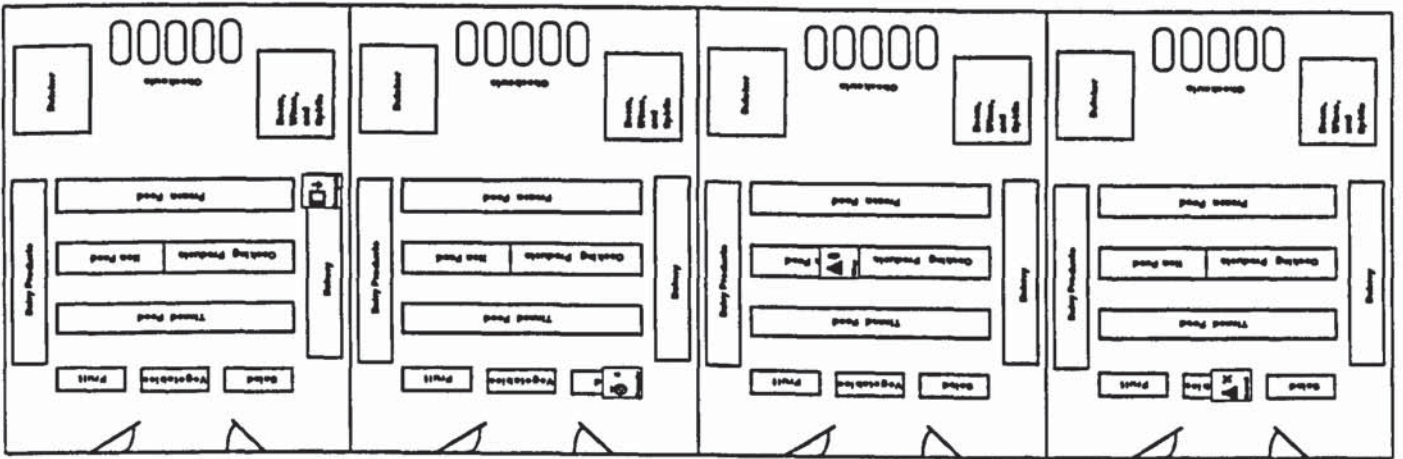
You are required to read the message(s) and note down the corresponding pattern of alarm messages.

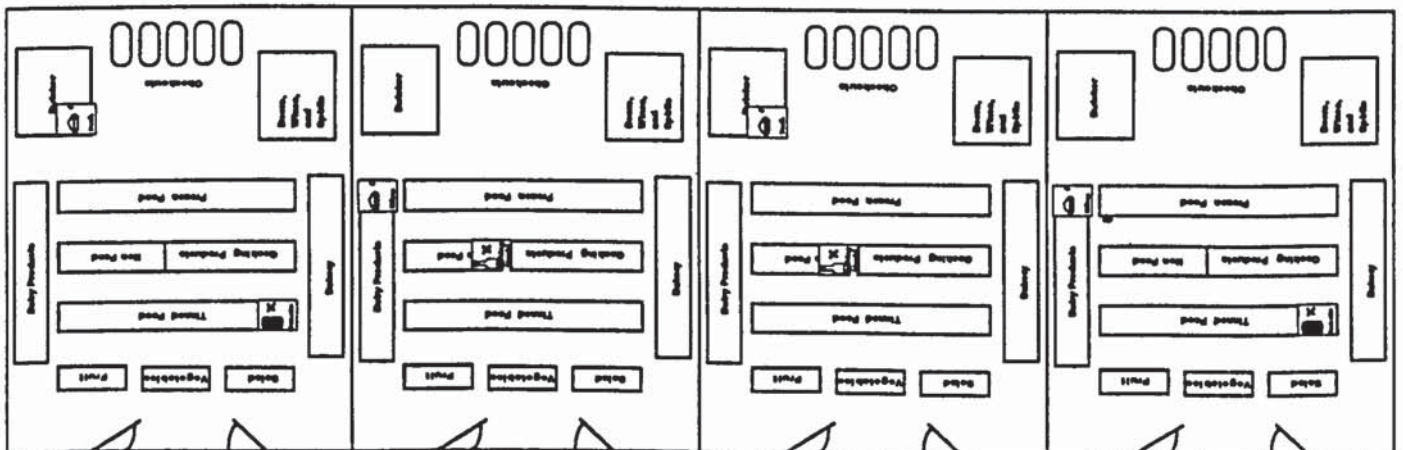
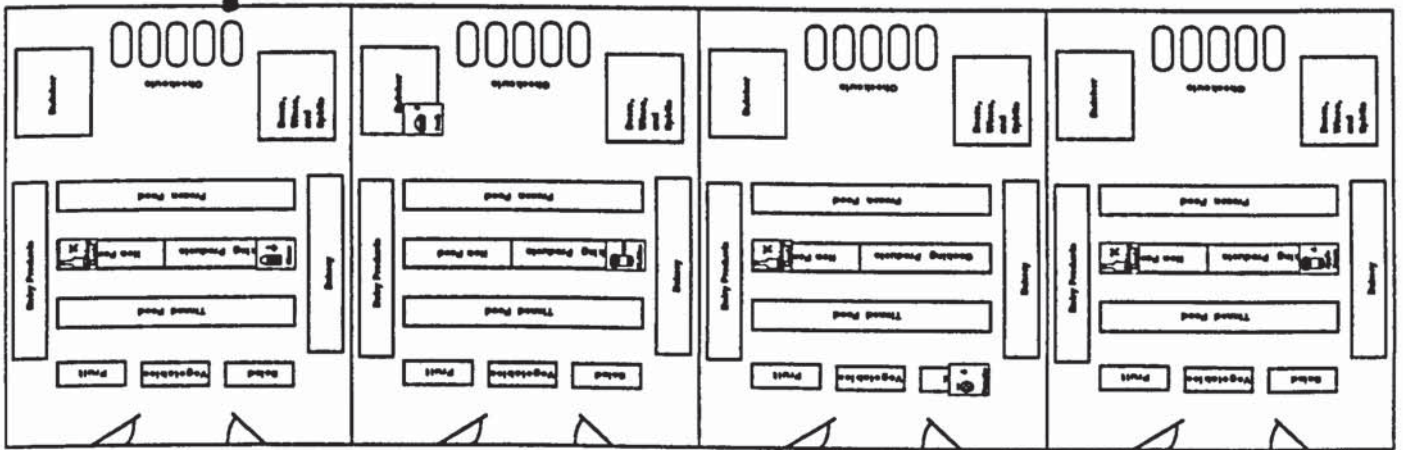
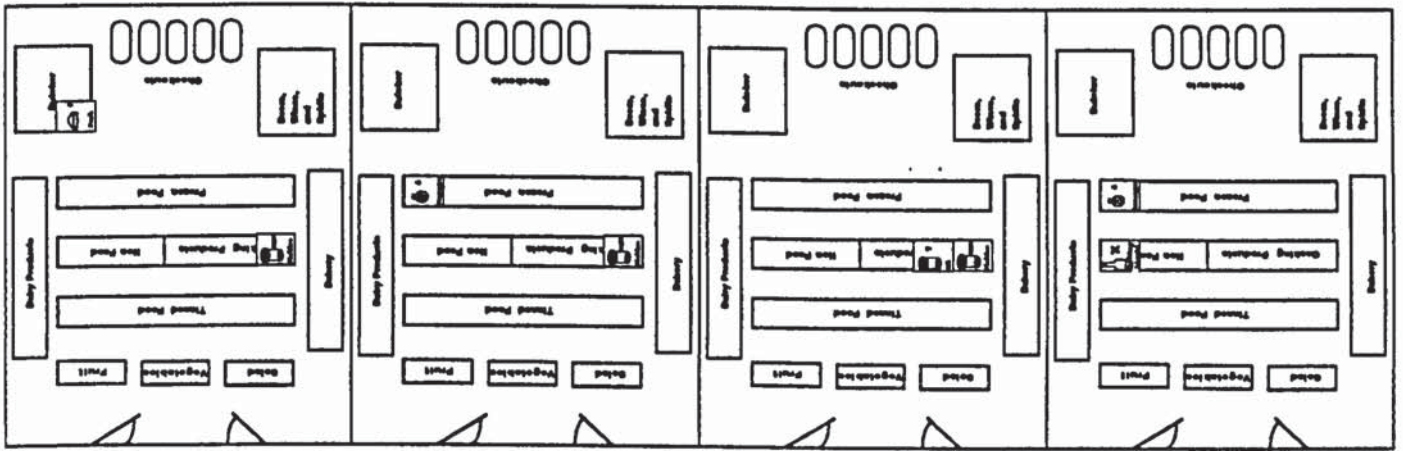
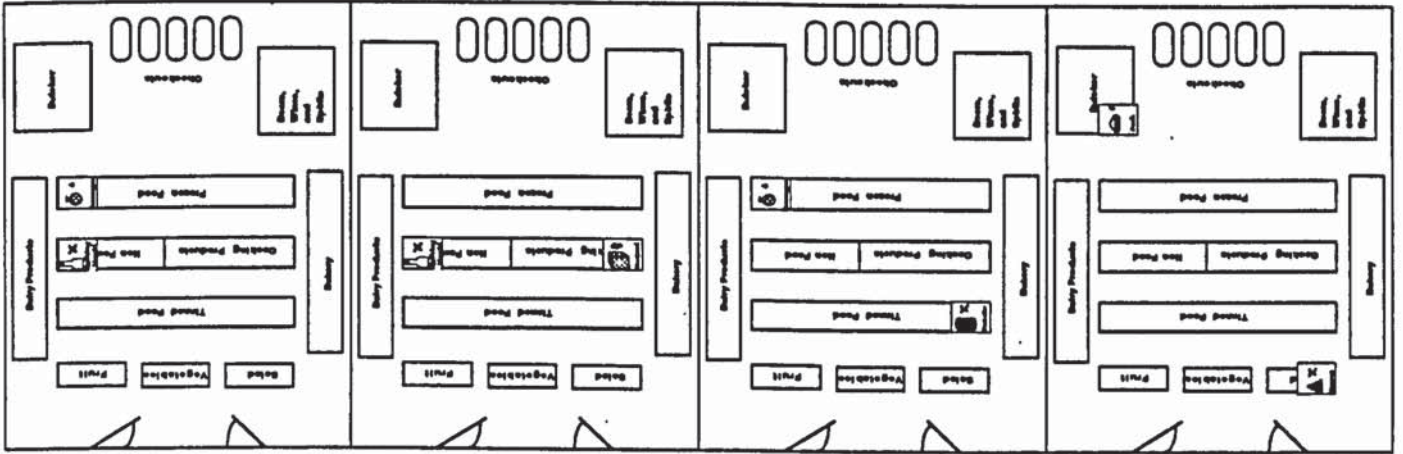
Subject Data

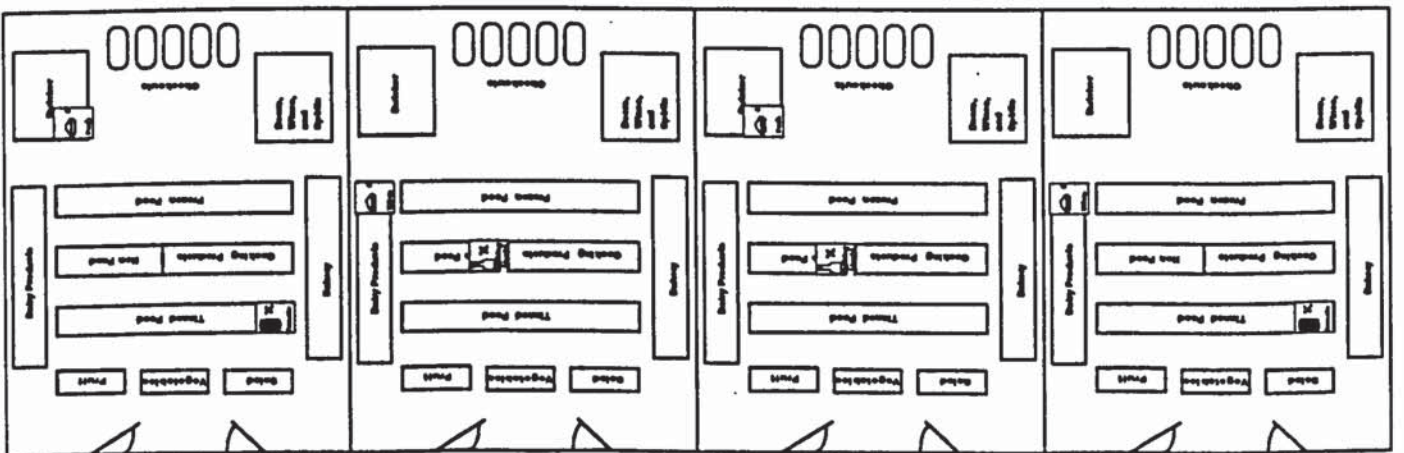
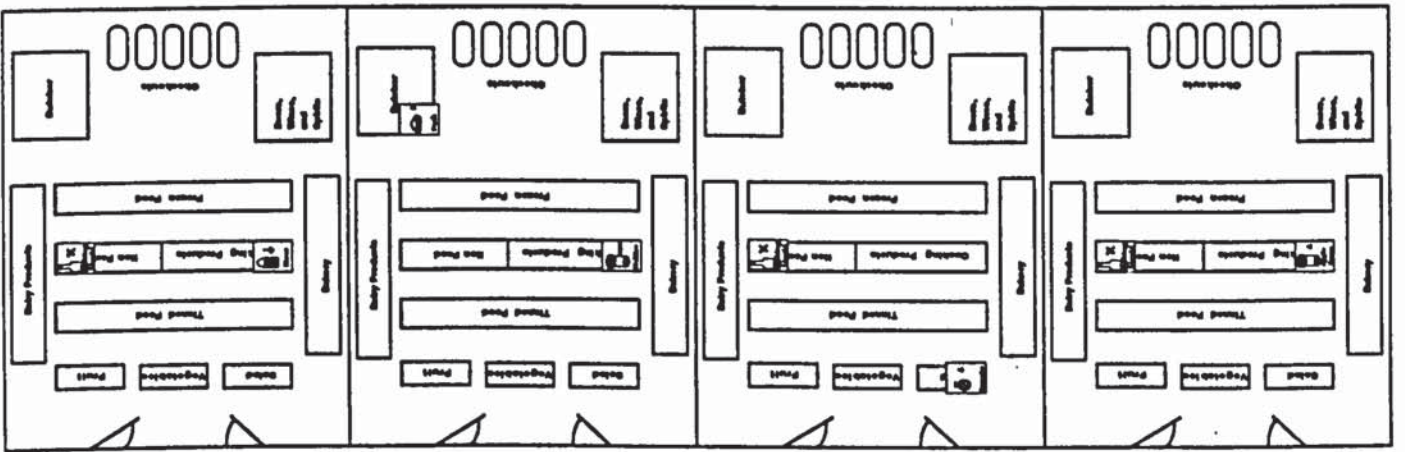
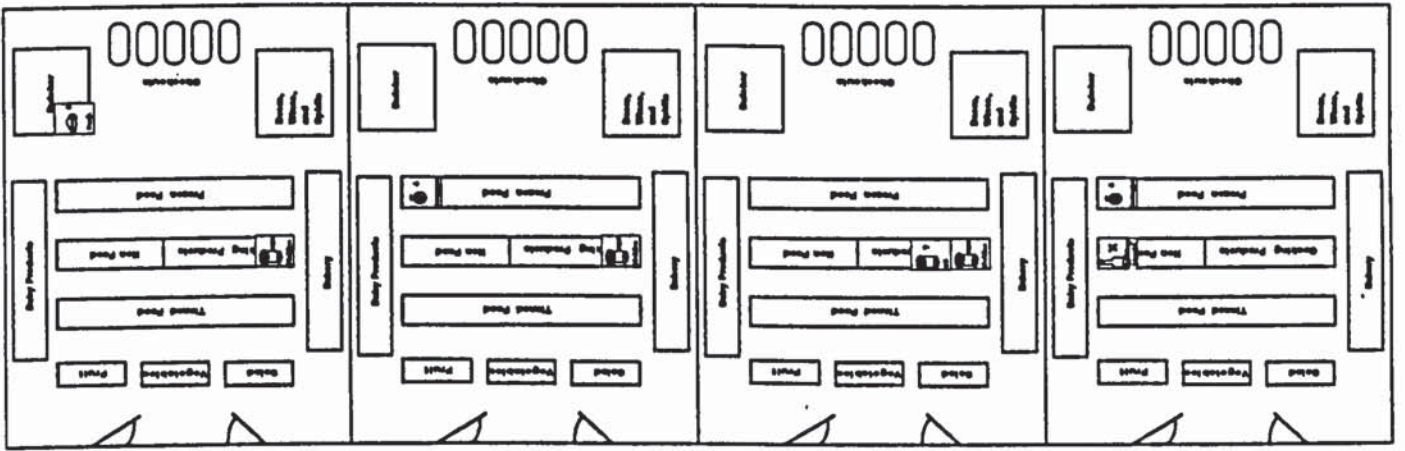
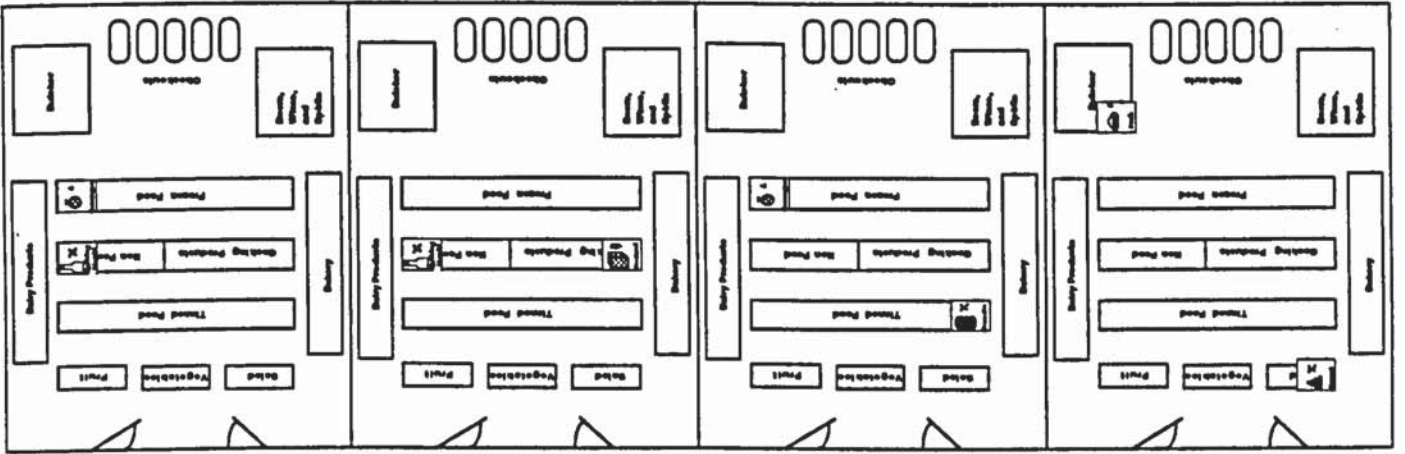
How old are you in years? ____ yrs

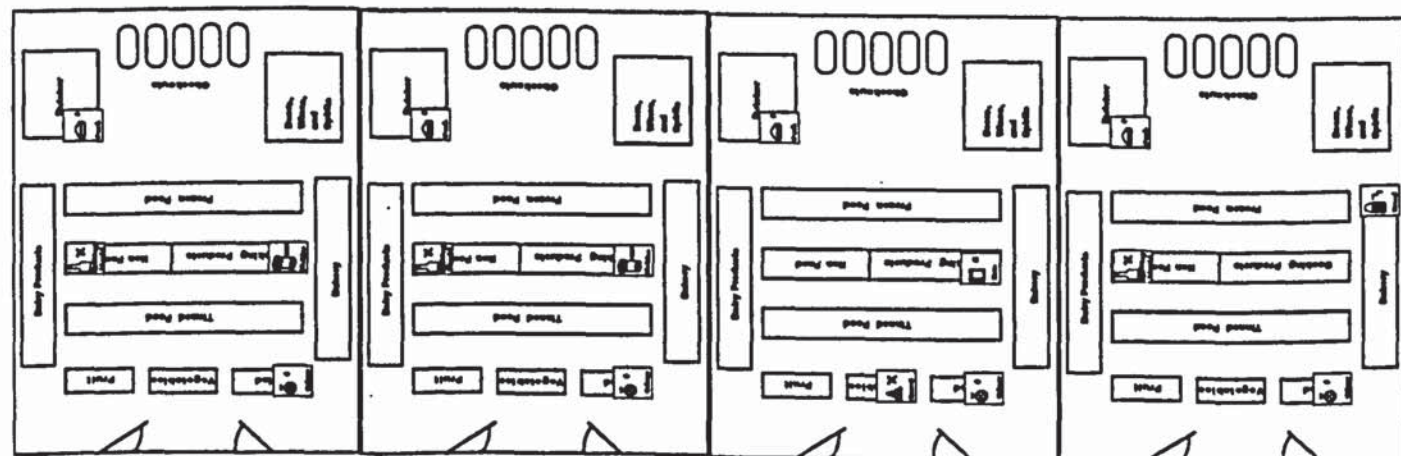
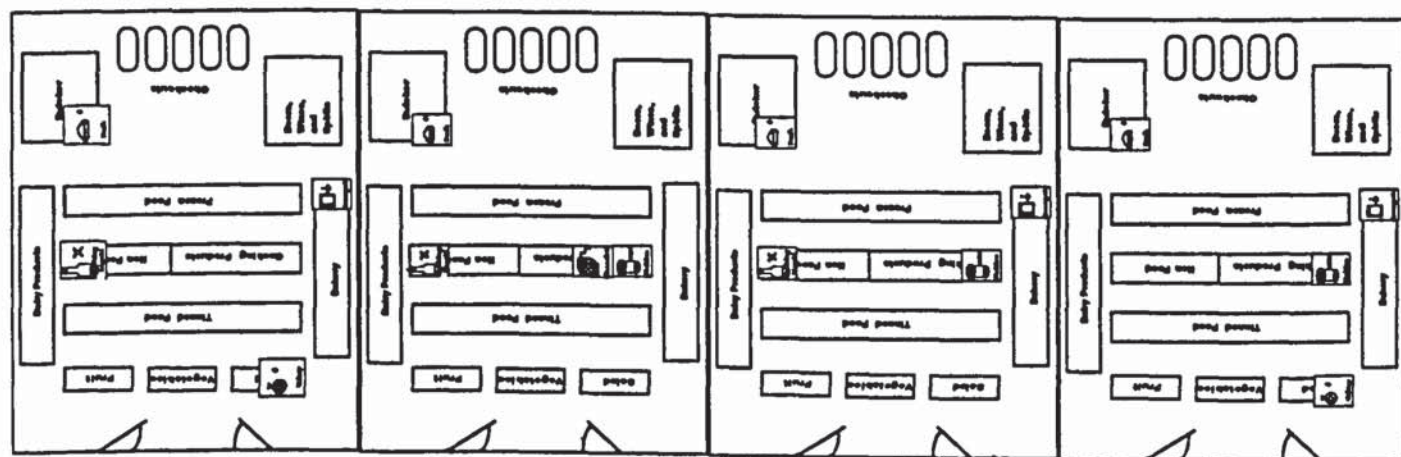
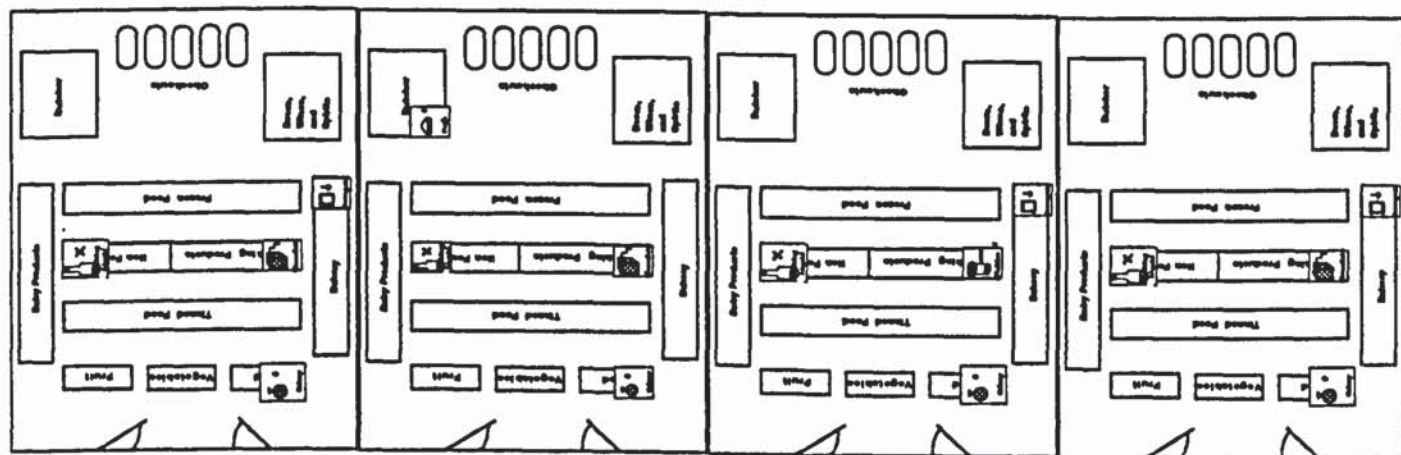
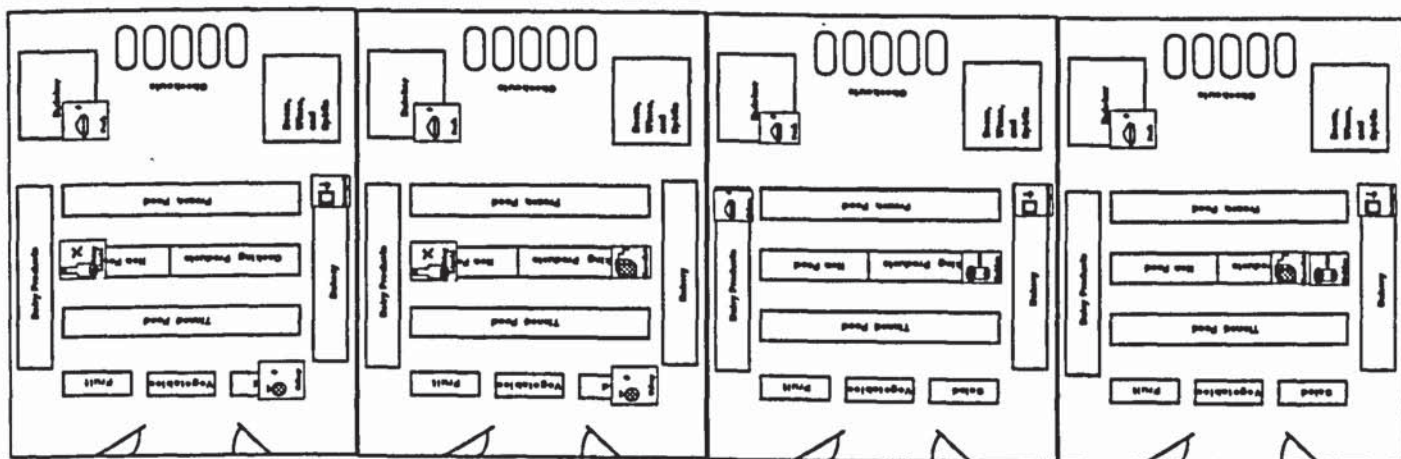
Are you male or female? MALE / FEMALE (circle as appropriate)

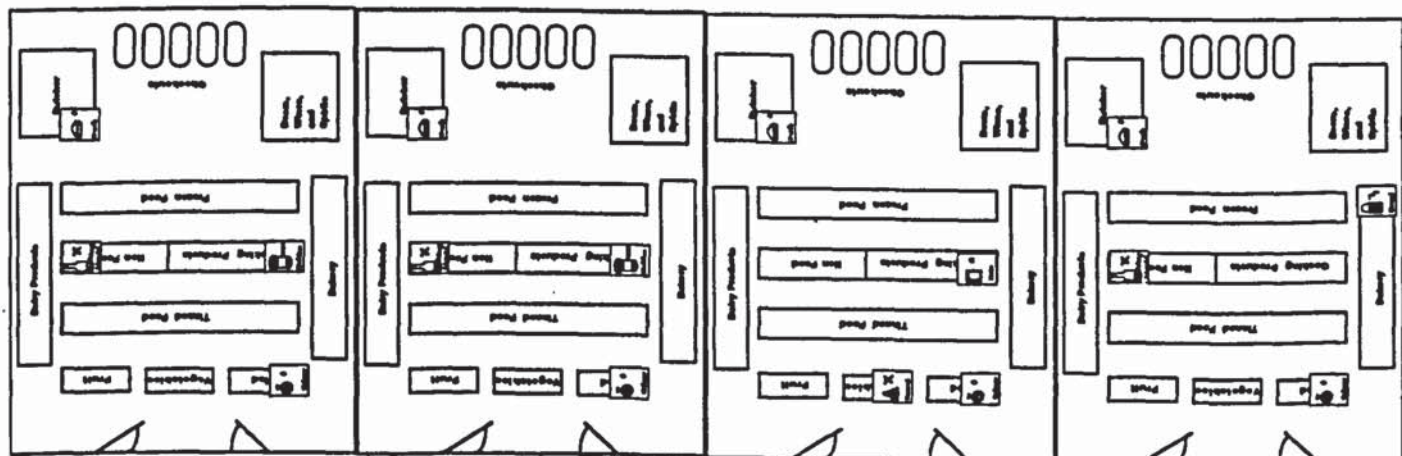
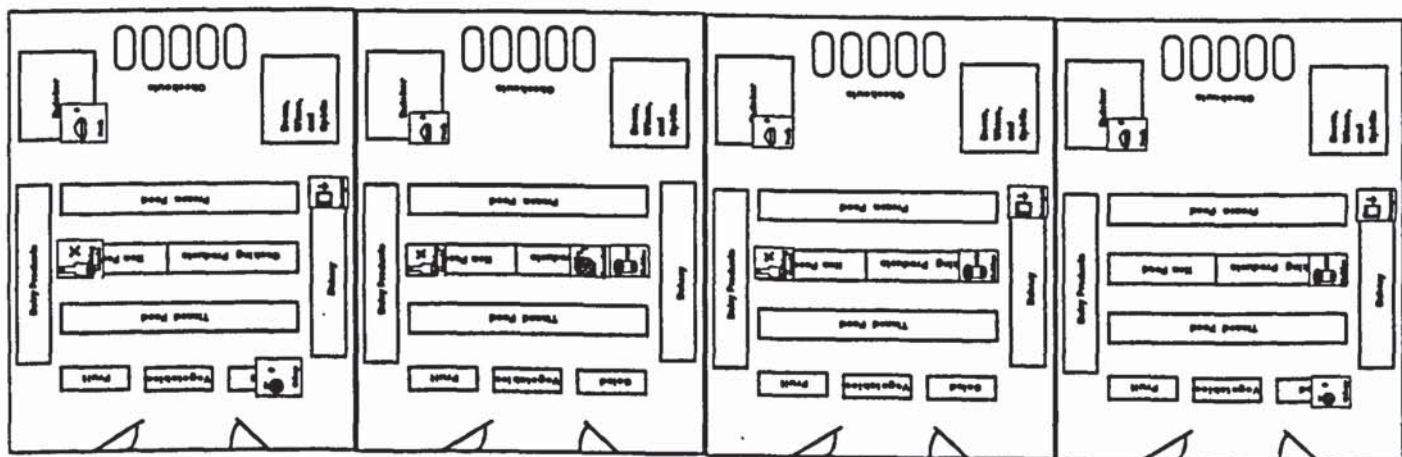
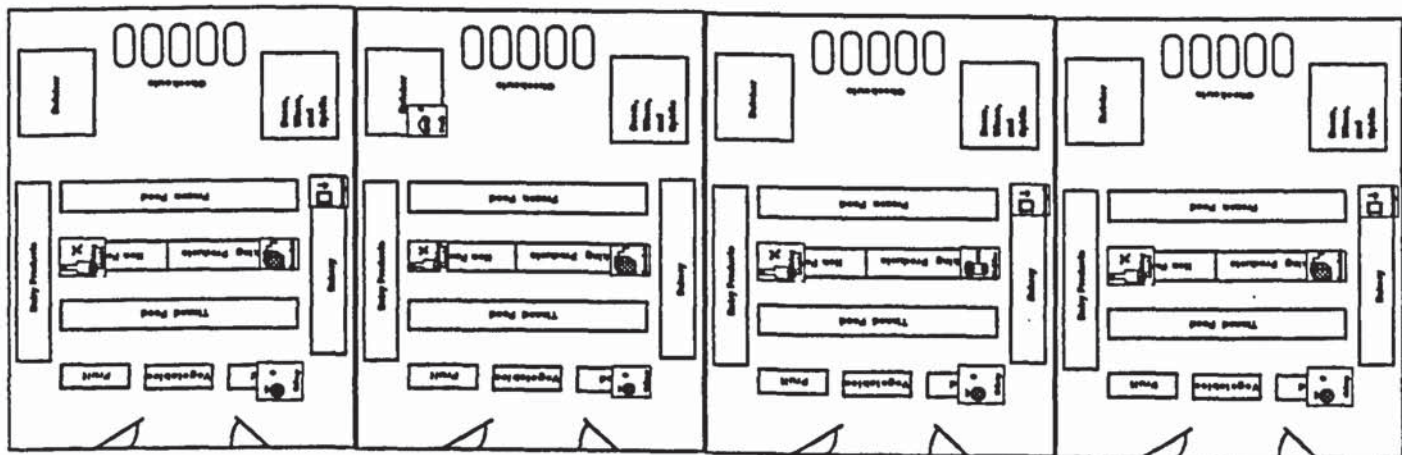
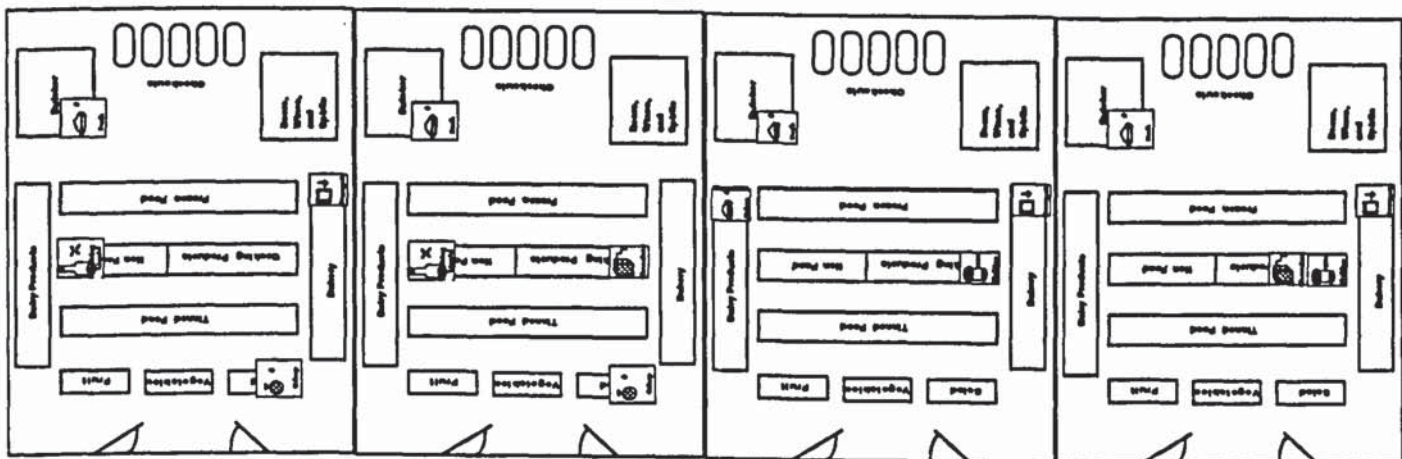


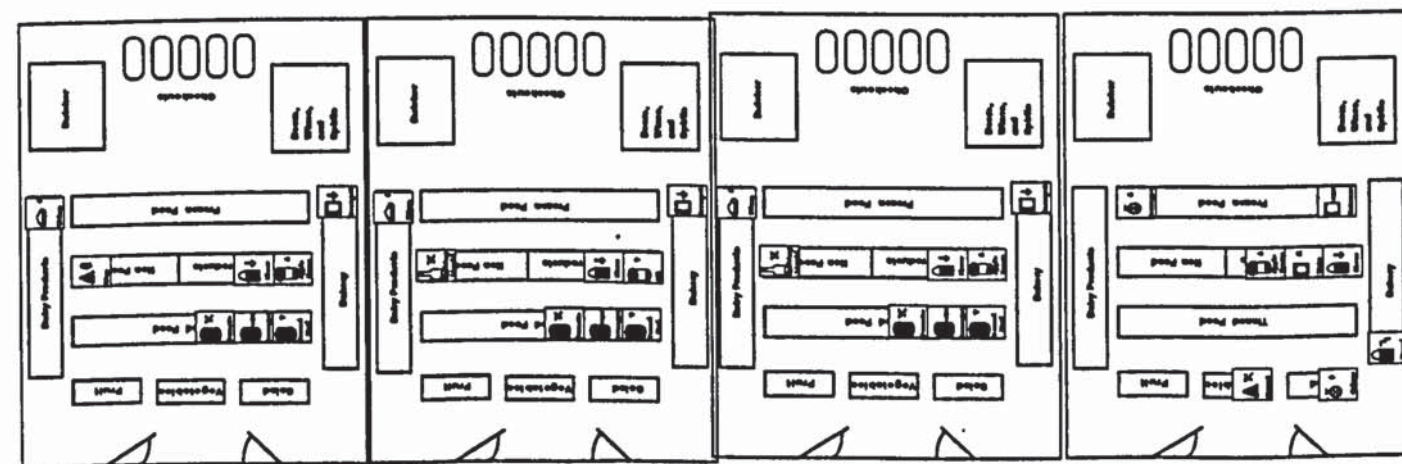
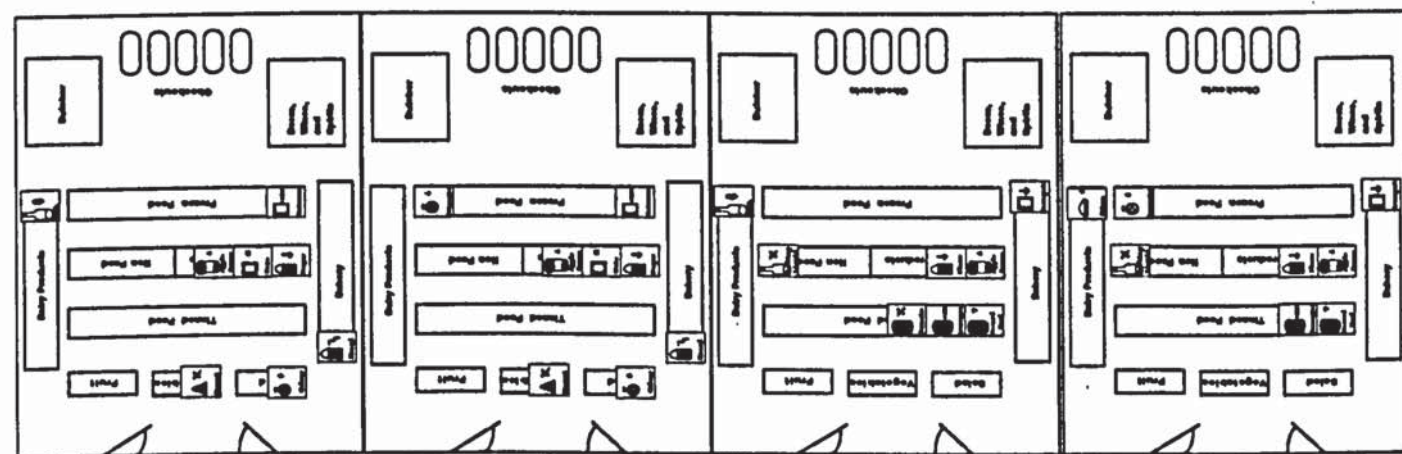
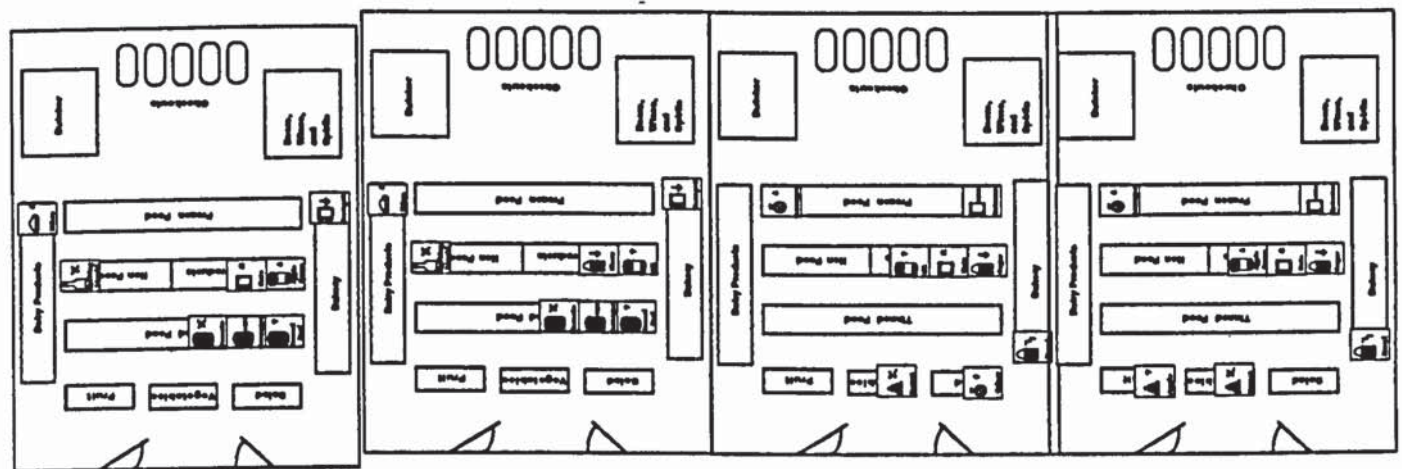
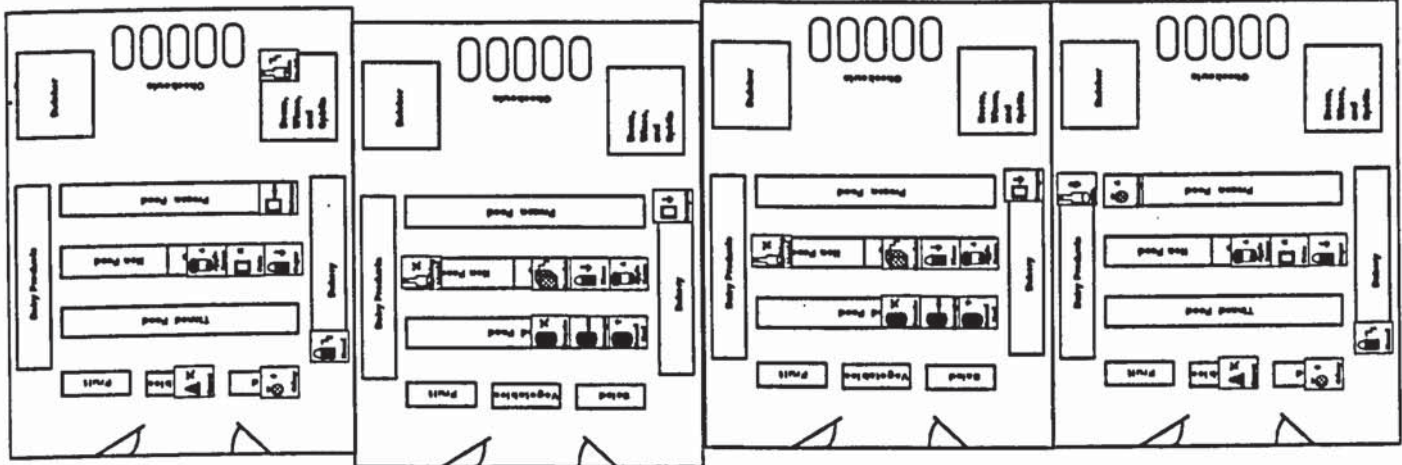


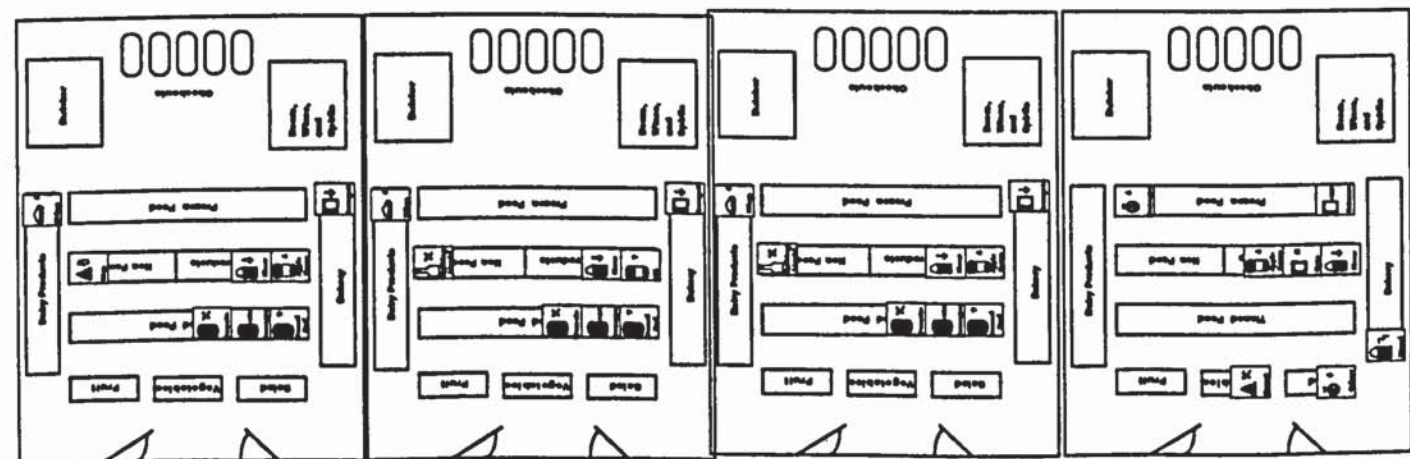
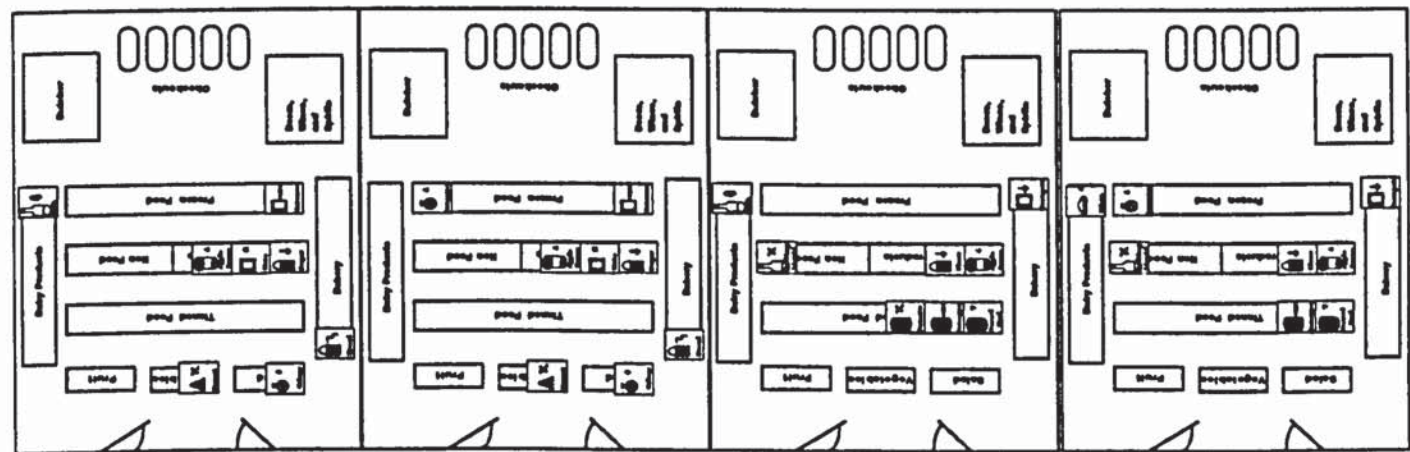
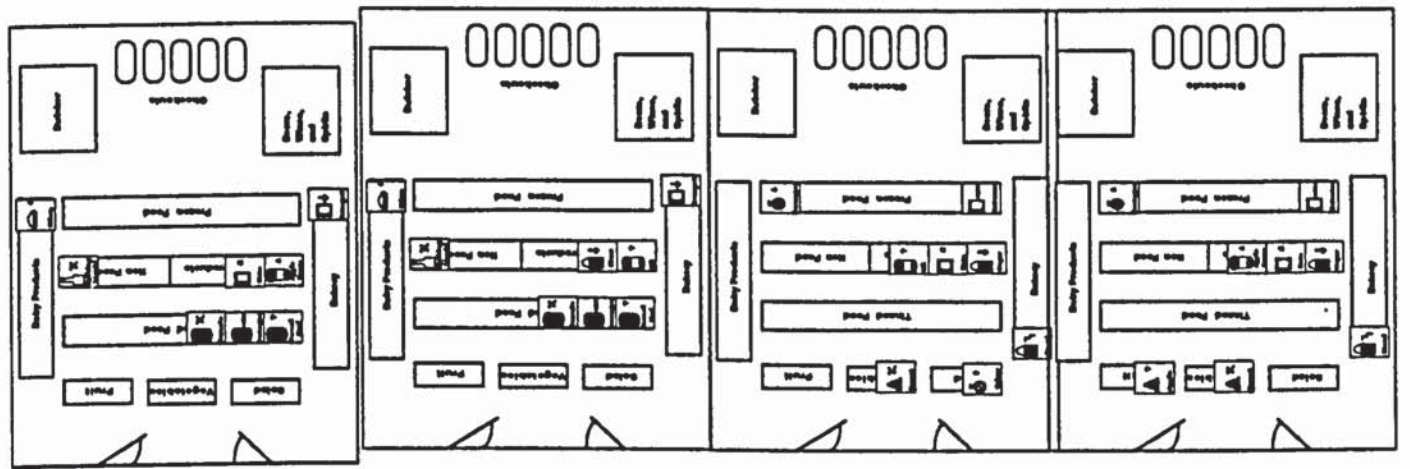
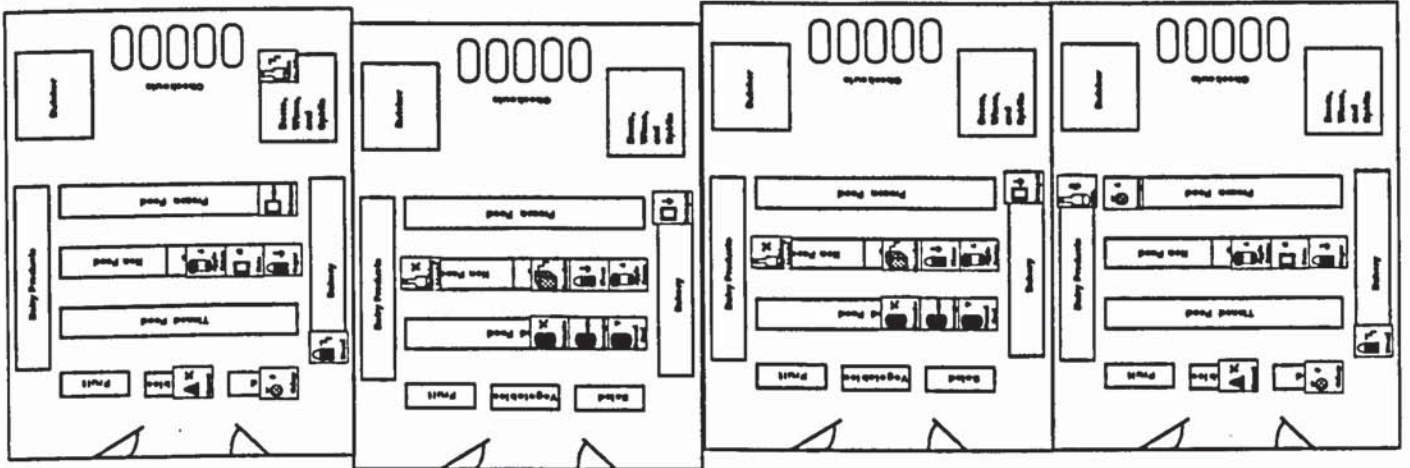


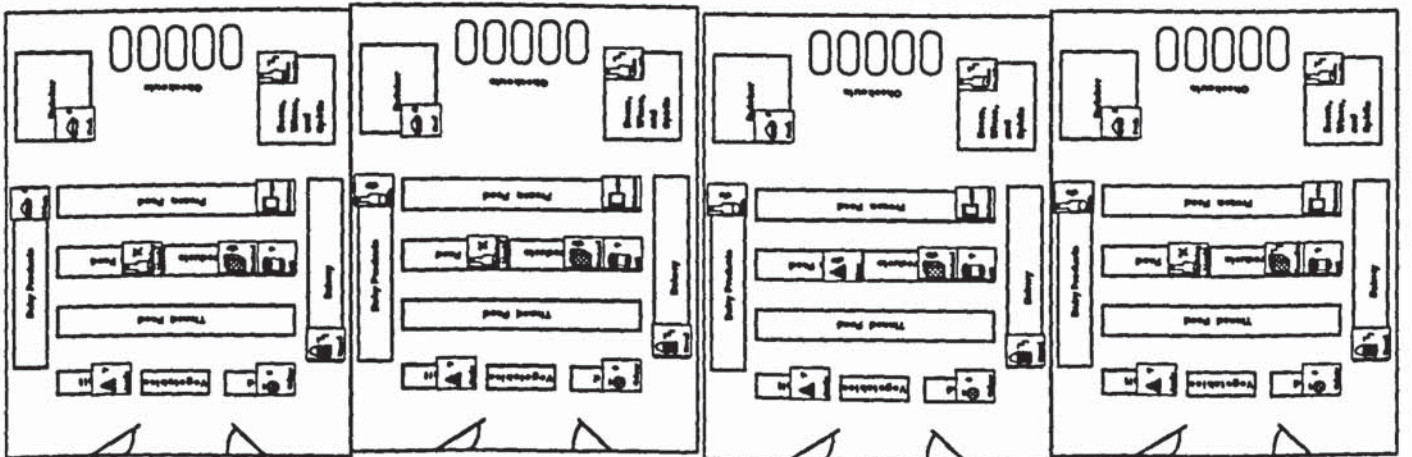
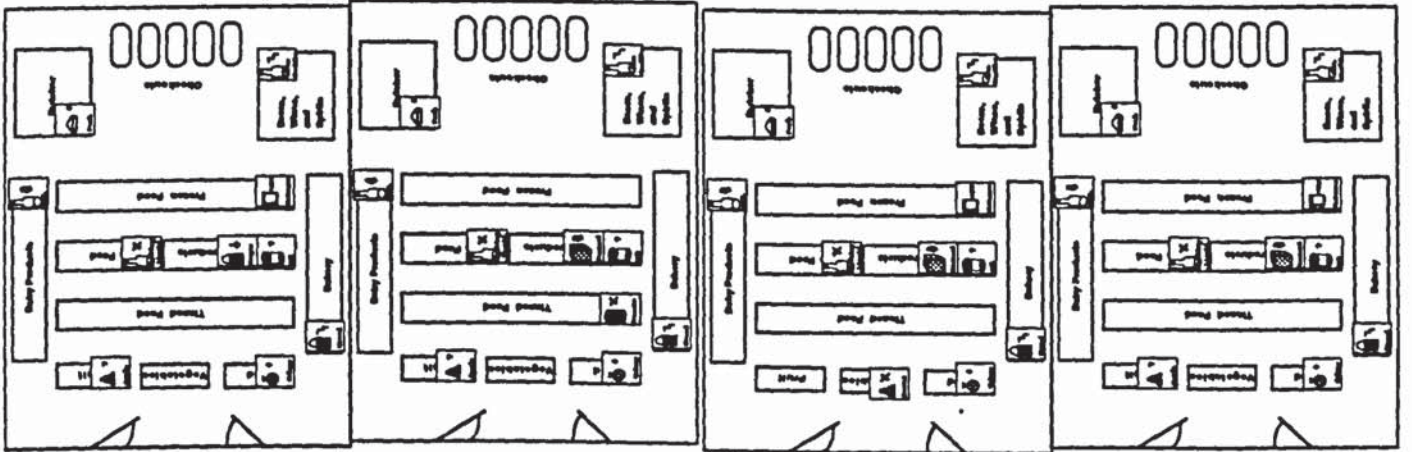
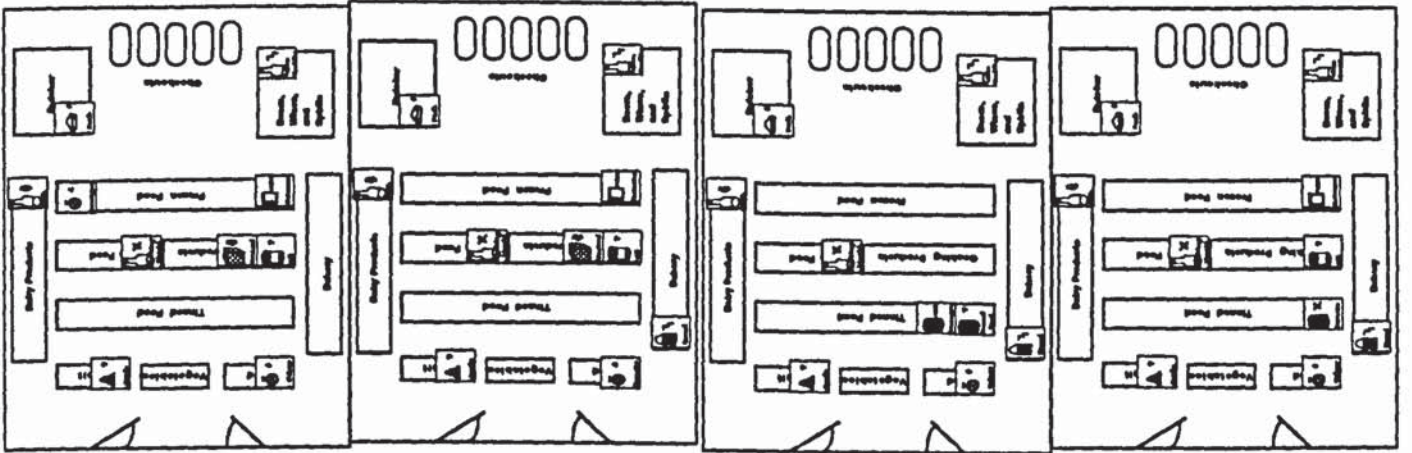
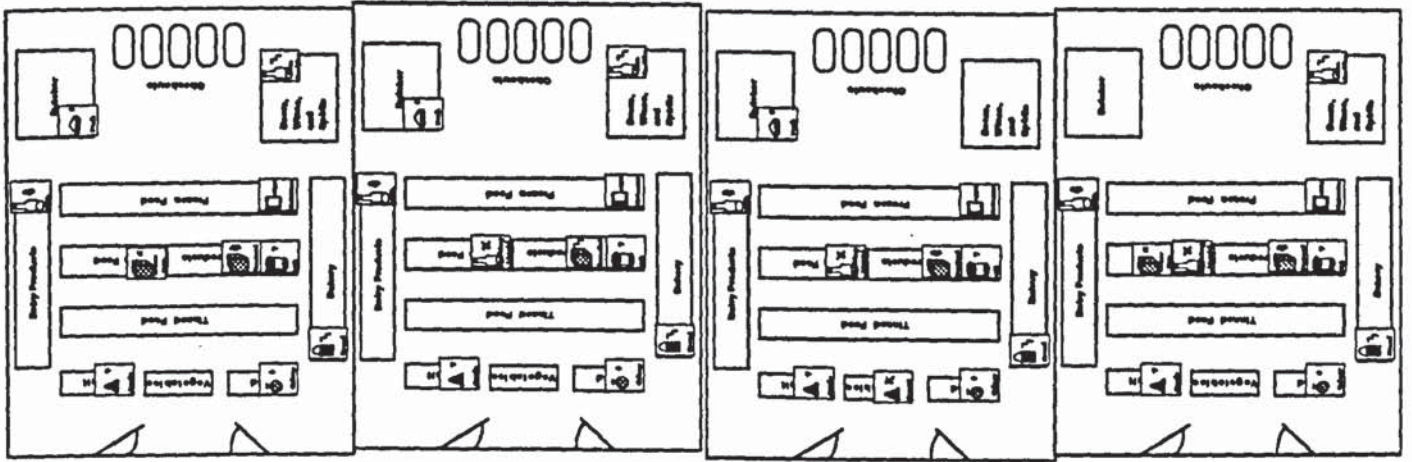


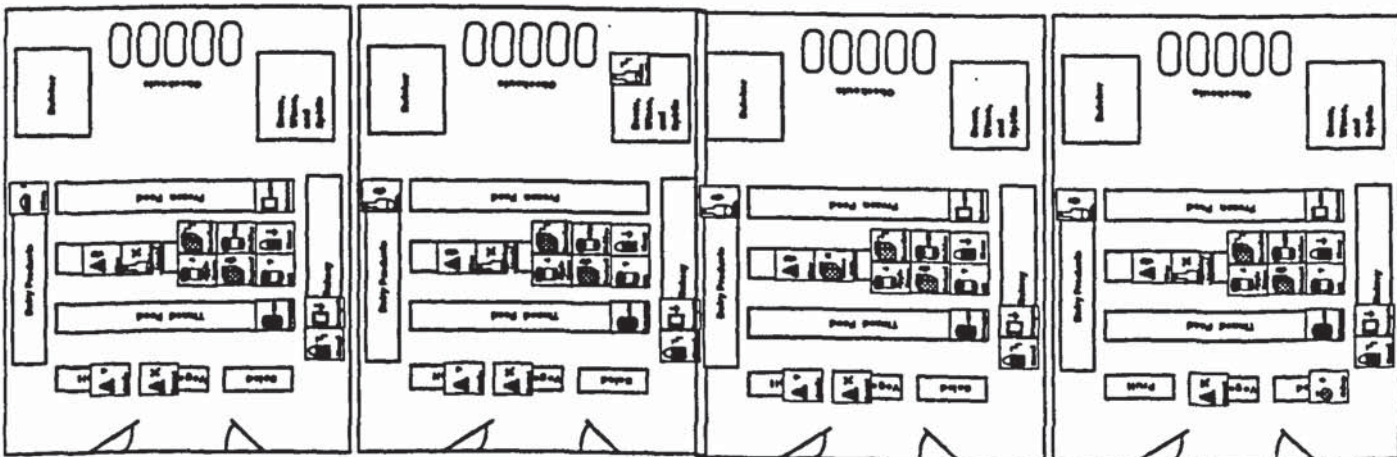
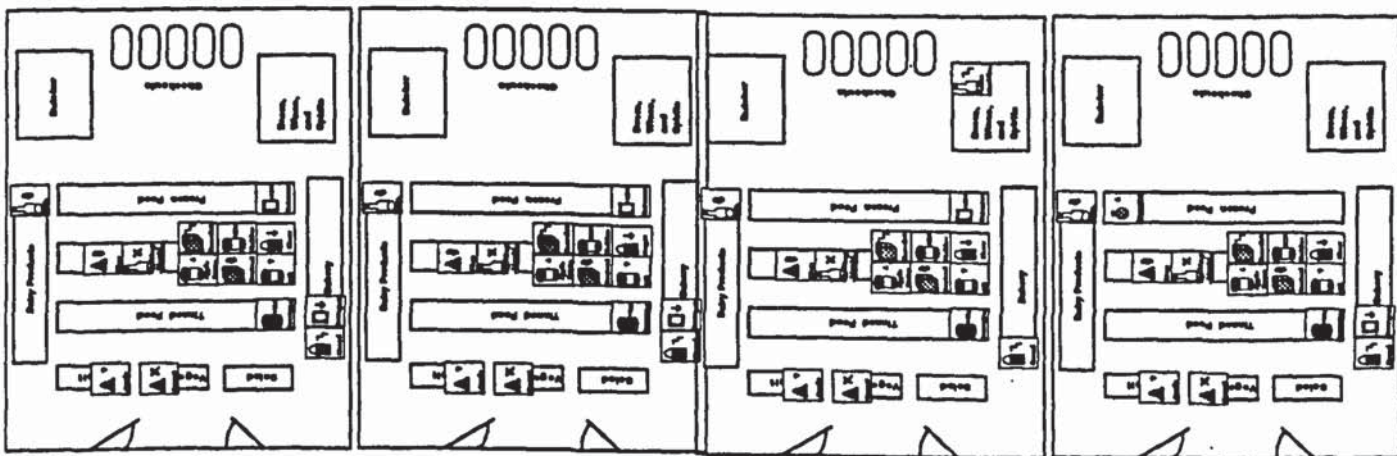
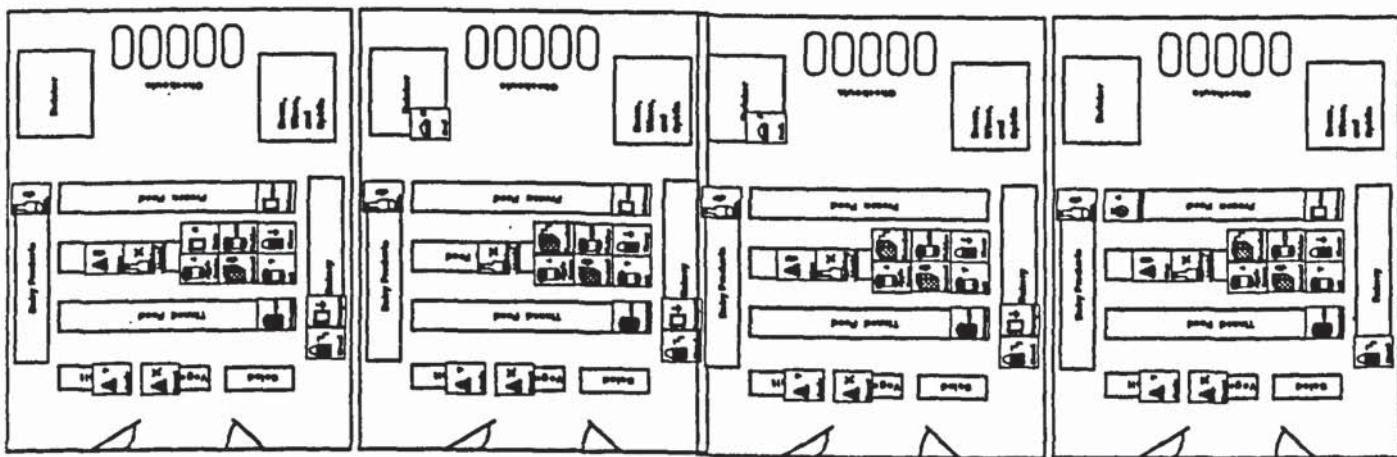
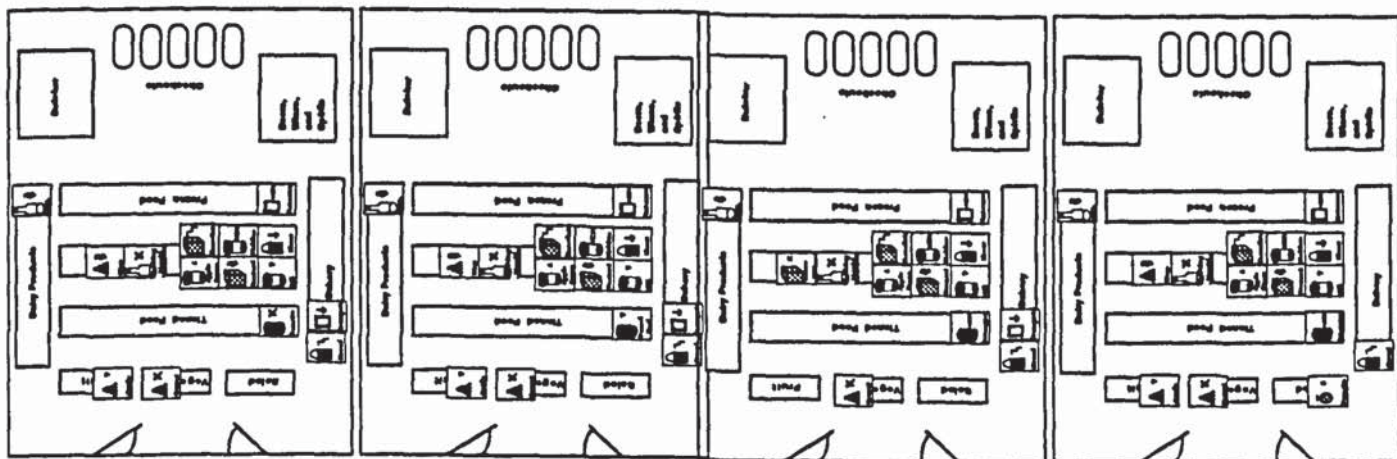


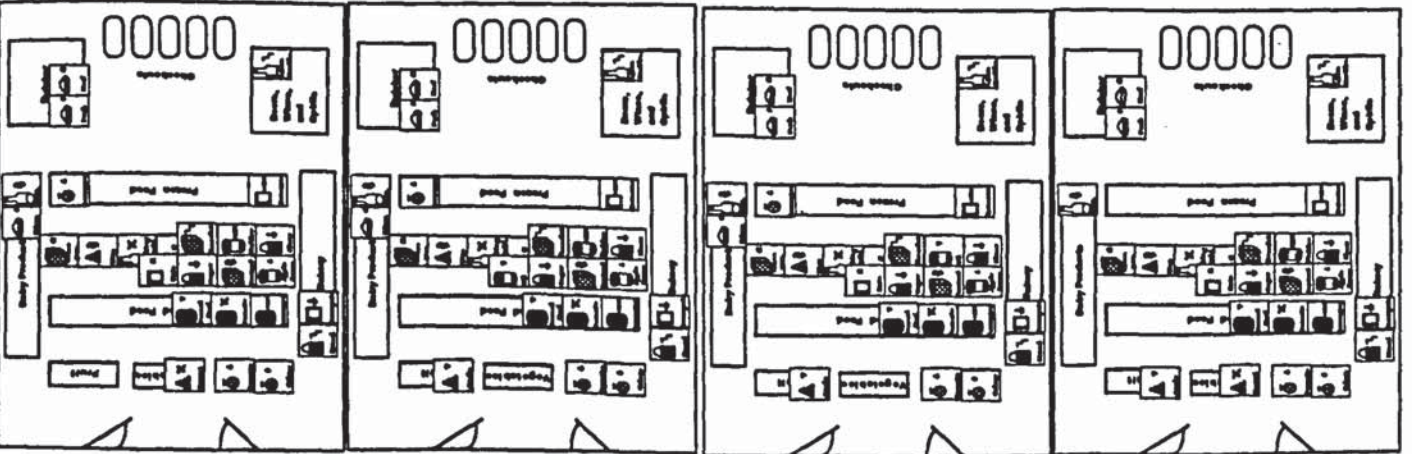
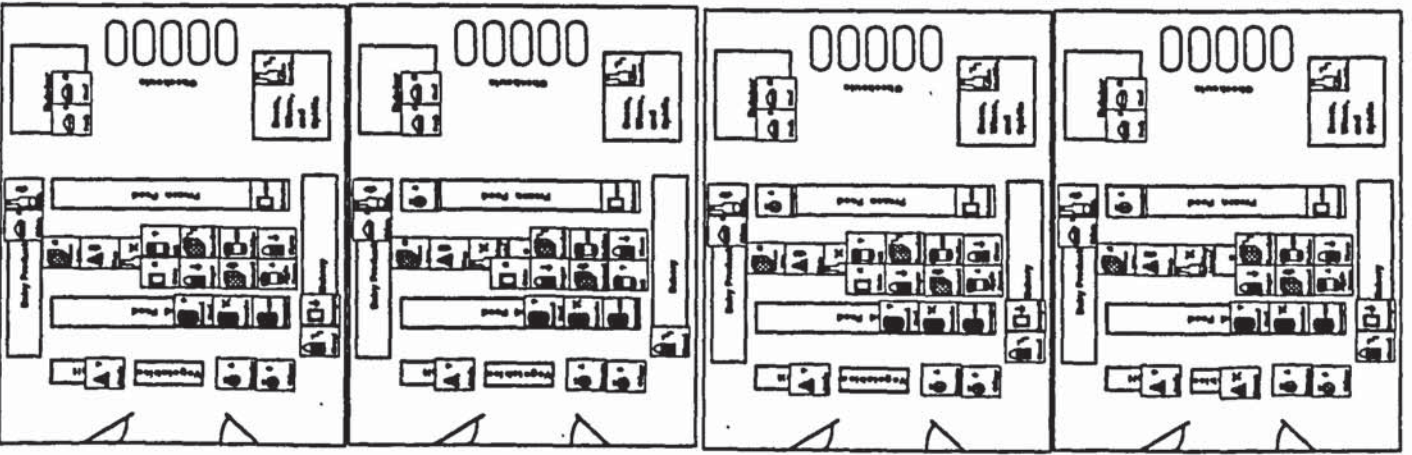
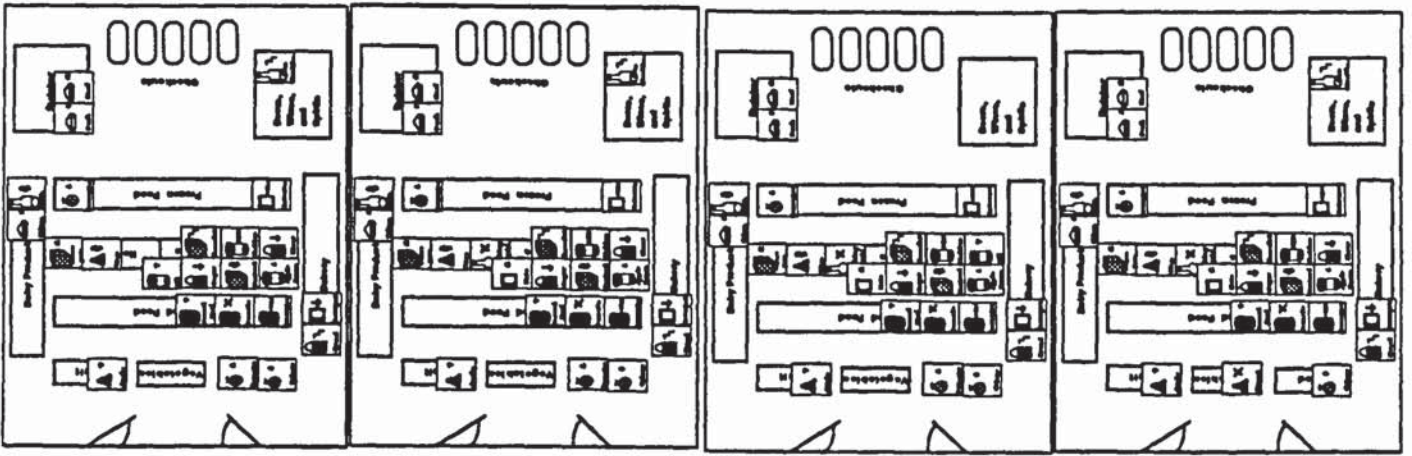
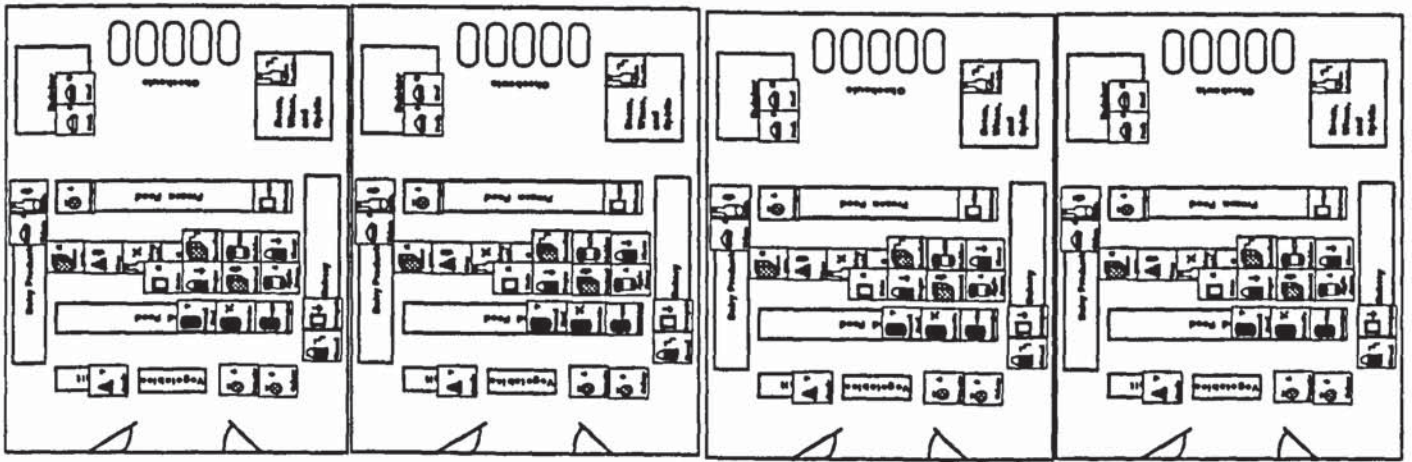










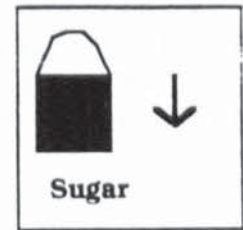




1. Bag _ Breakage



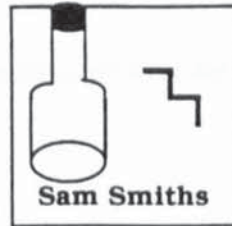
2. Bag _ Low



3. Bag _ Low



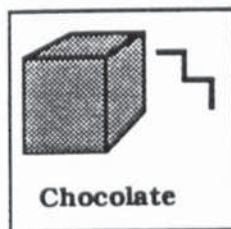
4. Bottle _ Return



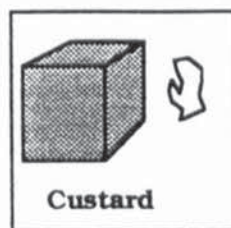
5. Bottle _ Breakage



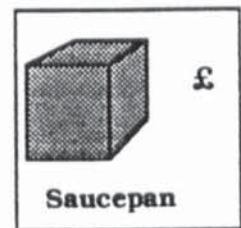
6. Bottle _ Empty



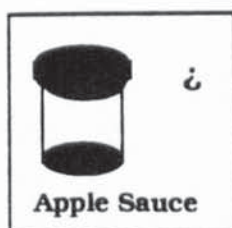
7. Box _ Breakage



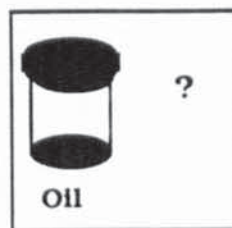
8. Box _ Return



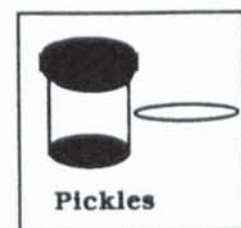
9. Box _ Price



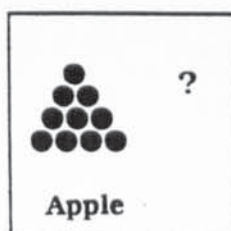
10. Jar _ Dressing



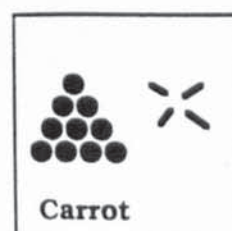
11. Jar _ Misplaced



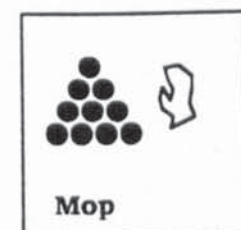
12. Jar _ Spillage



13. Loose _ Misplaced



14. Loose _ Empty



15. Loose _ Return

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record the order in which they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

1	Jar Oil Misplaced	10 Shrinkwrap Beef Price	19 Bottle Washing Liquid Empty
2	Tin Corned Beef Misplaced	11 Box Saucepan Price	20 Tin Tomato Empty
3	Loose Apple Misplaced	12 Packet Nuts Price	21 Loose Carrot Empty
4	Wrapped Tomato Dressing	13 Packet Crumpets Low	22 Jar Pickles Spillage
5	Wrapped Sausages Dressing	14 Bag Sugar Low	23 Packet Gateaux Spillage
6	Jar Apple Sauce Dressing	15 Bag Flour Low	24 Tin Sausages Spillage
7	Box Custard Return	16 Shrinkwrap Pork Past Date	25 Box Chocolate Breakage
8	Bottle Milk Return	17 Shrinkwrap Edam Past Date	26 Bag Bread Breakage
9	Loose Mop Return	18 Wrapped Celery Past Date	27 Bottle Sam Smiths Breakage

ORDER OF PRESENTATION

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.
- 20.
- 21.
- 22.
- 23.
- 24.
- 25.
- 26.
- 27.

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and record this on the location where they were presented.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

1	Jar Oil Misplaced	10	Shrinkwrap Beef Price	19	Bottle Washing Liquid Empty
2	Tin Corned Beef Misplaced	11	Box Saucepan Price	20	Tin Tomato Empty
3	Loose Apple Misplaced	12	Packet Nuts Price	21	Loose Carrot Empty
4	Wrapped Tomato Dressing	13	Packet Crumpets Low	22	Jar Pickles Spillage
5	Wrapped Sausages Dressing	14	Bag Sugar Low	23	Packet Gateaux Spillage
6	Jar Apple Sauce Dressing	15	Bag Flour Low	24	Tin Sausages Spillage
7	Box Custard Return	16	Shrinkwrap Pork Past Date	25	Box Chocolate Breakage
8	Bottle Milk Return	17	Shrinkwrap Edam Past Date	26	Bag Bread Breakage
9	Loose Mop Return	18	Wrapped Celery Past Date	27	Bottle Sam Smiths Breakage

Butcher

Checkouts

Beers,
Wines,
and
Spirits

Dairy Products

Frozen Food

Non Food

Cooking Products

Bakery

Tinned Food

Fruit

Vegetables

Salad

Introduction

Future supermarkets are likely to have reduced numbers of staff on the shop floor, putting the emphasis on a central control room. Sensors on the shop floor may be able to detect variations in the levels of stock on the shelves and any other problems such as breakages or unpriced goods. These sensors will then transmit the information to the control room and it will be the job of the control room staff to make decisions based on this information.

Instructions

In this experiment you will be asked to assume the role of a member of the supermarket control room staff. You will be presented with a series of alarm messages. Each message consists of three components: the product container; the product; and the problem.

You are required to read the message(s) and note down the corresponding pattern of alarm messages.

Subject Data

How old are you in years? ____ yrs

Are you male or female? MALE / FEMALE (circle as appropriate)

1	Jar Oil Misplaced	10 Shrinkwrap Beef Price	19 Bottle Washing Liquid Empty
2	Tin Corned Beef Misplaced	11 Box Saucepan Price	20 Tin Tomato Empty
3	Loose Apple Misplaced	12 Packet Nuts Price	21 Loose Carrot Empty
4	Wrapped Tomato Dressing	13 Packet Crumpets Low	22 Jar Pickles Spillage
5	Wrapped Sausages Dressing	14 Bag Sugar Low	23 Packet Gateaux Spillage
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7	Box Custard Return	16 Shrinkwrap Pork Past Date	25 Box Chocolate Breakage
8	Bottle Milk Return	17 Shrinkwrap Edam Past Date	26 Bag Bread Breakage
9	Loose Mop Return	18 Wrapped Celery Past Date	27 Bottle Sam Smiths Breakage

[illegible][illegible][illegible][illegible]

Kruskal-Wallis X₁ : Temporal Y₁ : %Correct

DF	2	
* Groups	3	
* Cases	18	
H	12.424	p = .002
H corrected for ties	12.488	p = .0019
* tied groups	2	

Kruskal-Wallis X₁ : Temporal Y₁ : %Correct

Group:	* Cases:	Σ Rank:	Mean Rank:
Text	6	93	15.5
Annunciator	6	48.5	8.083
Mimic	6	29.5	4.917

Mann-Whitney U X₁ : Temporal Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Text	6	57	9.5
Mimic	6	21	3.5

U	0
U-prime	36
Z	-2.882 p = .0039
Z corrected for ties	-2.903 p = .0037
# tied groups	1

Mann-Whitney U X₁ : Temporal Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Text	6	57	9.5
Annunciator	6	21	3.5

U	0
U-prime	36
Z	-2.882 p = .0039
Z corrected for ties	-2.903 p = .0037
* tied groups	1

Mann-Whitney U X₁ : Temporal Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Annunciator	6	48.5	8.083
Mimic	6	29.5	4.917

U	8.5	
U-prime	27.5	
Z	-1.521	p = .1282
Z corrected for ties	-1.524	p = .1275
* tied groups	1	

Kruskal-Wallis X₁ : Spatial Y₁ : %Correct

DF	2	
# Groups	3	
# Cases	18	
H	11.605	p = .003
H corrected for ties	11.739	p = .0028
# tied groups	2	

Kruskal-Wallis X₁ : Spatial Y₁ : %Correct

Group:	# Cases:	Σ Rank:	Mean Rank:
Text	6	43.5	7.25
Annunciator	6	34.5	5.75
Mimic	6	93	15.5

Mann-Whitney U X₁ : Spatial Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Text	6	21	3.5
Mimic	6	57	9.5

U	0	
U-prime	36	
Z	-2.882	p = .0039
Z corrected for ties	-2.934	p = .0033
# tied groups	1	

Mann-Whitney U X₁ : Spatial Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Annunciator	6	21	3.5
Mimic	6	57	9.5

U	0	
U-prime	36	
Z	-2.882	p = .0039
Z corrected for ties	-2.934	p = .0033
* tied groups	1	

Mann-Whitney U X₁ : Spatial Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Text	6	43.5	7.25
Annunciator	6	34.5	5.75

U	13.5	
U-prime	22.5	
Z	-.721	p = .4712
Z corrected for ties	-.722	p = .4704
# tied groups	1	

Kruskal-Wallis X₁ : Pattern Y₁ : %Correct

DF	2	
* Groups	3	
* Cases	18	
H	7.693	p = .0214
H corrected for ties	7.939	p = .0189
* tied groups	5	

Kruskal-Wallis X₁ : Pattern Y₁ : %Correct

Group:	# Cases:	Σ Rank:	Mean Rank:
Text	6	69.5	11.583
Annunciator	6	74	12.333
Mimic	6	27.5	4.583

Mann-Whitney U X₁ : Pattern Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
. Text	6	52.5	8.75
Mimic	6	25.5	4.25

U	4.5	
U-prime	31.5	
Z	-2.162	p = .0306
Z corrected for ties	-2.209	p = .0272
# tied groups	3	

Mann-Whitney U X₁ : Pattern Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Annunciator	6	55	9.167
Mimic	6	23	3.833

U	2	
U-prime	34	
Z	-2.562	p = .0104
Z corrected for ties	-2.589	p = .0096
* tied groups	3	

Mann-Whitney U X₁ : Pattern Y₁ : %Correct

	Number:	Σ Rank:	Mean Rank:
Text	6	38	6.333
Annunciator	6	40	6.667

U	17	
U-prime	19	
Z	-.16	p = .8728
Z corrected for ties	-.164	p = .8698
# tied groups	4	

One Factor ANOVA X₁ : Temporal Y₁ : Time (secs)

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	881070.778	440535.389	14.743
Within groups	15	448199.667	29879.978	p = .0003
Total	17	1329270.444		

Model II estimate of between component variance = 68442.569

One Factor ANOVA X₁ : Temporal Y₁ : Time (secs)

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Text	6	502.167	118.454	48.359
Annunciator	6	436.167	137.305	56.054
Mimic	6	935	238.235	97.259

One Factor ANOVA X₁ : Temporal Y₁ : Time (secs)

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Text vs. Annunciator	66	212.718	.219	.661
Text vs. Mimic	-432.833	212.718*	9.405*	4.337
Annunciator vs. Mimic	-498.833	212.718*	12.492*	4.998

* Significant at 95%

One Factor ANOVA X₁ : Spatial Y₁ : Time (secs)

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	142832.333	71416.167	2.9
Within groups	15	369435.667	24629.044	p = .0862
Total	17	512268		

Model II estimate of between component variance = 7797.854

One Factor ANOVA X₁ : Spatial Y₁ : Time (secs)

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Text	6	758.833	112.98	46.124
Annunciator	6	597	156.582	63.924
Mimic	6	551.167	191.323	78.107

One Factor ANOVA X₁ : Spatial Y₁ : Time (secs)

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Text vs. Annunciator	161.833	193.125	1.595	1.786
Text vs. Mimic	207.667	193.125*	2.626	2.292
Annunciator vs. Mimic	45.833	193.125	.128	.506

* Significant at 95%

One Factor ANOVA X₁ : Pattern Y₁ : Time (secs)

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	281001	140500.5	9.662
Within groups	15	218115	14541	p = .002
Total	17	499116		

Model II estimate of between component variance = 20993.25

One Factor ANOVA X₁ : Pattern Y₁ : Time (secs)

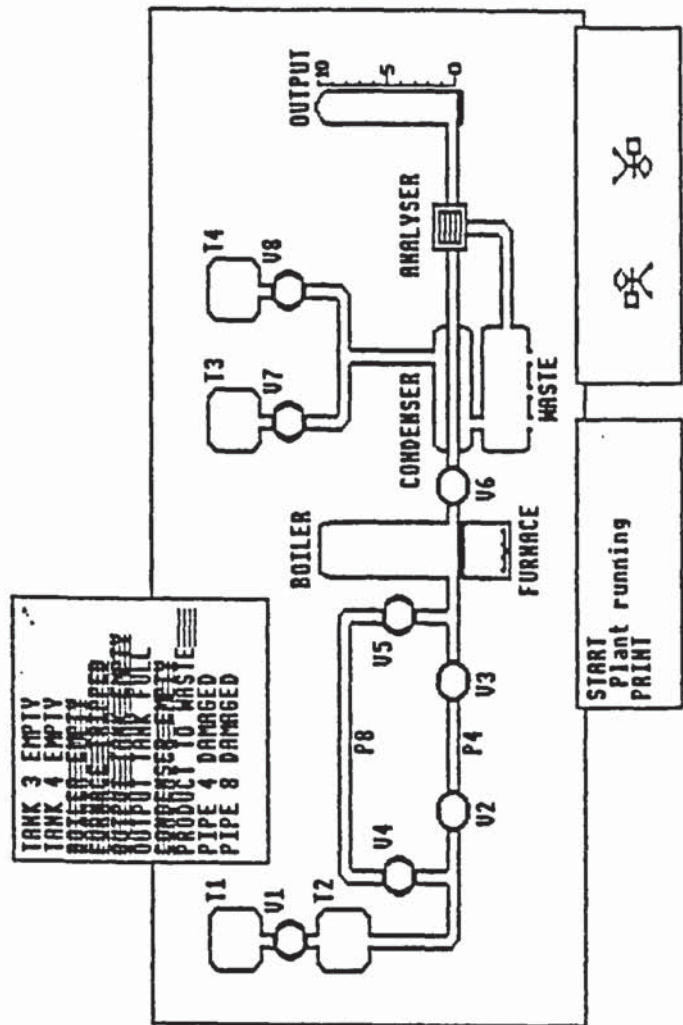
Group:	Count:	Mean:	Std. Dev.:	Std. Error:
Text	6	525.833	170.362	69.55
Annunciator	6	268.333	111.315	45.444
Mimic	6	253.833	46.995	19.186

One Factor ANOVA X₁ : Pattern Y₁ : Time (secs)

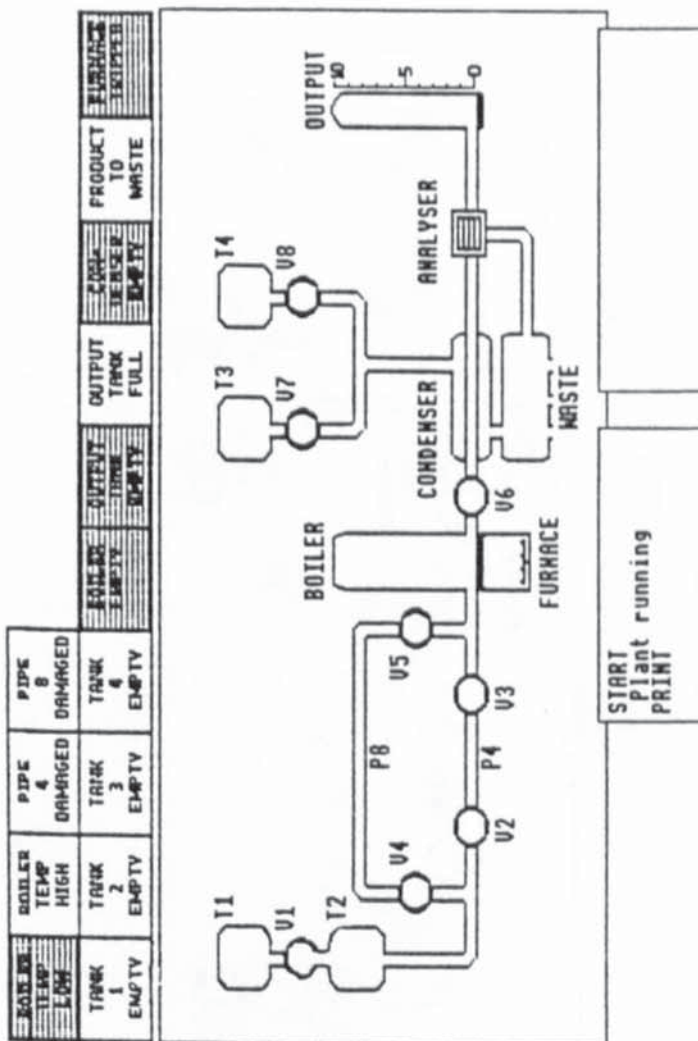
Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Text vs. Annunciator	257.5	148.392*	6.84*	3.699
Text vs. Mimic	272	148.392*	7.632*	3.907
Annunciator vs. Mimic	14.5	148.392	.022	.208

* Significant at 95%

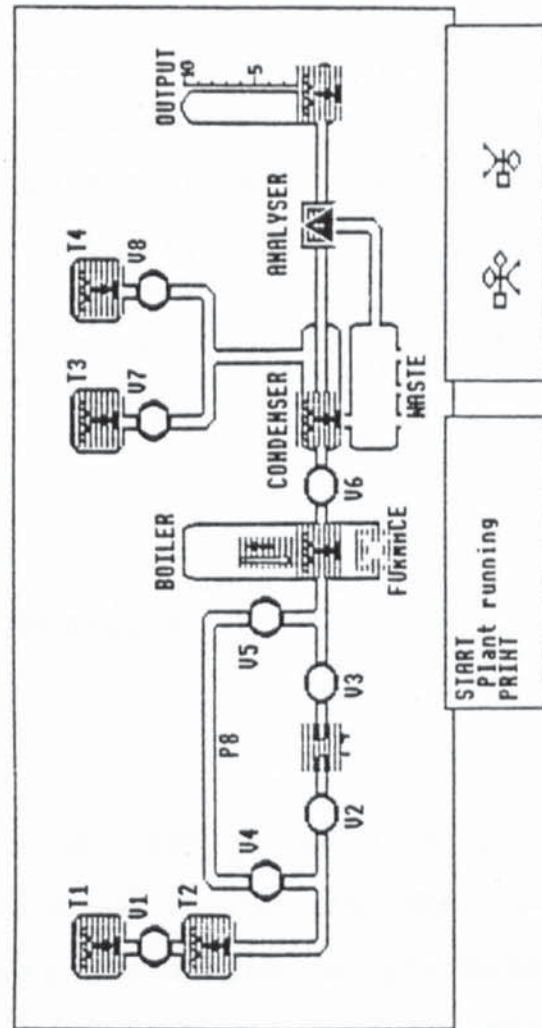
Alphanumeric Alarm System



Annunciator Alarm System



Mimic Alarm System



Instructions given to subjects before each experimental trial

Trial 1

I now want you to run the simulator again, but this time you will not be able to constantly see the process you are controlling. Instead you will be able to inspect individual plant components for a few seconds at a time by using the F5 to F11 keys:

F5 inspects tanks (press f5, then the number of the tank, then <return>)

F6 inspects valves

F7 inspects pipes

F8 inspects the output level

F9 inspects the level of fluid in the boiler

F10 inspects the boiler temperature

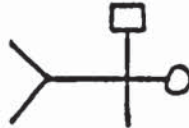
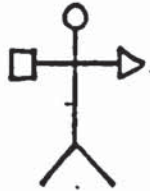
F11 inspects the furnace

However, to help you in controlling the plant you will be provided with an alarm system. Alarms will flash red to indicate the state of plant components, and you must accept the alarms by pressing the <space> bar. Apart from this, you should continue to run the simulator as before.

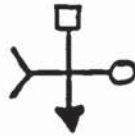
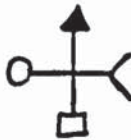
Trial 2

I am now going to ask you to run the simulator one last time. It will use the same alarm system as before but this time you will be required to attend to a secondary task as well. You will be shown two figures in a box to the lower right of the screen. Your task is to determine as quickly and as accurately as possible whether the

two figures are the same, to make things more difficult they may be presented in different degrees of rotation. For example,



are different, and

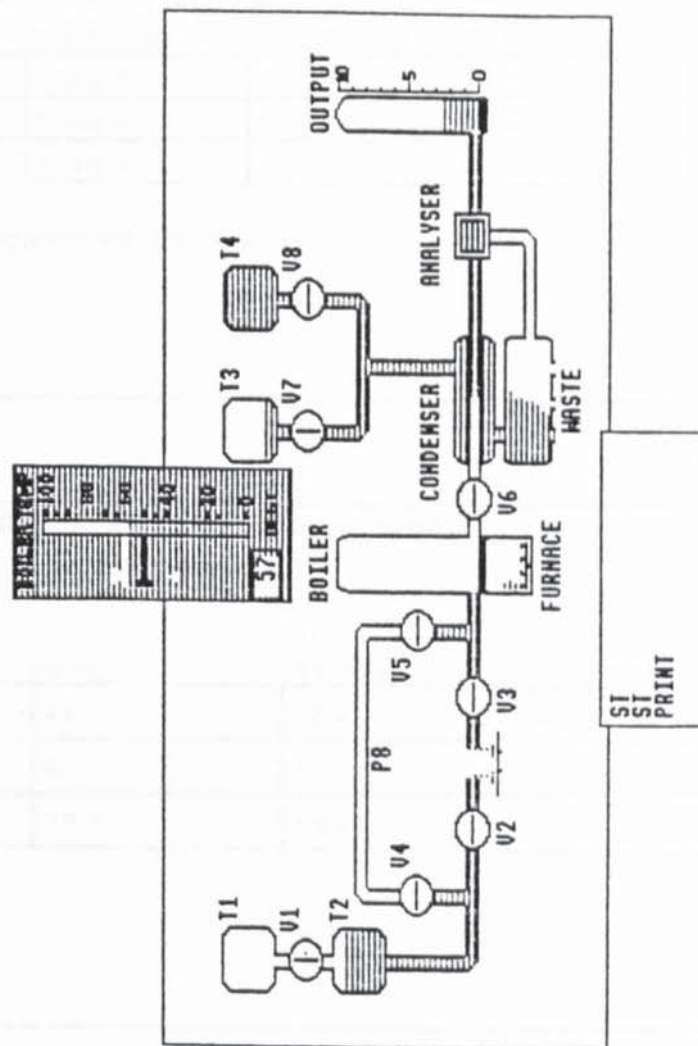


are the same.

You respond by pressing the left-hand button of the mouse for YES, and the right-hand button for NO:

Y		N

Example of plant schematic in operation, showing pipe break and the boiler temperature under inspection.



Total Output

One Factor ANOVA X 1 : Conditions Y 1 : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	1414.5	707.2	3.3
Within groups	26	5604.9	215.6	p = .0536
Total	28	7019.4		

Model II estimate of between component variance = 50.9

One Factor ANOVA X 1 : Conditions Y 1 : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	9	91.1	12.4	4.1
text	10	93	10.5	3.3
annunciator	10	77.5	19.4	6.1

One Factor ANOVA X 1 : Conditions Y 1 : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	-1.9	13.9	3.9E-2	.3
mimic vs. annunciator	13.6	13.9	2	2
text vs. annunciator	15.5	13.5*	2.8	2.4

* Significant at 95%

Mean accept time

One Factor ANOVA X 1 : Conditions Y 1 : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	9665447.9	4832724	1.7
Within groups	22	62637403.1	2847154.7	p = .2063
Total	24	72302851		

Model II estimate of between component variance = 240967.1

One Factor ANOVA X 1 : Conditions Y 1 : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	10	1495.8	1257.7	397.7
text	7	910	345.5	130.6
annunciator	8	2486.2	2610	922.8

One Factor ANOVA X 1 : Conditions Y 1 : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	585.8	1724.5	.2	.7
mimic vs. annunciator	-990.4	1659.9	.8	1.2
text vs. annunciator	-1576.2	1811.1	1.6	1.8

Mean diagnosis time

One Factor ANOVA X₁ : Conditions Y₁ : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	7368368.8	3684184.4	2.2
Within groups	26	43425767.9	1670221.8	p = .1304
Total	28	50794136.7		

Model II estimate of between component variance = 208589

One Factor ANOVA X₁ : Conditions Y₁ : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	10	3055.7	1672.7	529
text	9	2202.9	1114.1	371.4
annunciator	10	1877.9	961.1	303.9

One Factor ANOVA X₁ : Conditions Y₁ : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	852.8	1220.6	1	1.4
mimic vs. annunciator	1177.8	1188	2.1	2
text vs. annunciator	325	1220.6	.1	.5

Mean recovery time

One Factor ANOVA X₁ : Conditions Y₁ : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	10213318.8	5106659.4	1.9
Within groups	26	69895220.5	2688277.7	p = .1698
Total	28	80108539.3		

Model II estimate of between component variance = 250475.2

One Factor ANOVA X₁ : Conditions Y₁ : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	10	4715.2	2101.9	664.7
text	9	3457.7	1526.7	508.9
annunciator	10	3474.9	1129.7	357.3

One Factor ANOVA X₁ : Conditions Y₁ : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	1257.5	1548.5	1.4	1.7
mimic vs. annunciator	1240.3	1507.2	1.4	1.7
text vs. annunciator	-17.2	1548.5	2.6E-4	2.3E-2

Pipe break accept times

One Factor ANOVA X₁ : Conditions Y₁ : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	5947408.3	2973704.1	.9
Within groups	22	70766153.2	3216643.3	p = .4116
Total	24	76713561.4		

Model II estimate of between component variance = -29482.9

One Factor ANOVA X₁ : Conditions Y₁ : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	10	1998.2	2089.6	660.8
text	7	2405.4	1057.1	399.6
annunciator	8	3149.6	1880.9	665

One Factor ANOVA X₁ : Conditions Y₁ : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	-407.2	1833	.1	.5
mimic vs. annunciator	-1151.4	1764.3	.9	1.4
text vs. annunciator	-744.2	1925	.3	.8

Pipe break diagnosis times

One Factor ANOVA X₁ : Conditions Y₁ : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	399384.5	199692.3	.3
Within groups	24	15232518.9	634688.3	p = .733
Total	26	15631903.4		

Model II estimate of between component variance = -48332.9

One Factor ANOVA X₁ : Conditions Y₁ : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	9	1062	1138.6	379.5
text	9	764.1	553.1	184.4
annunciator	9	916.3	549.2	183.1

One Factor ANOVA X₁ : Conditions Y₁ : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	297.9	775.1	.3	.8
mimic vs. annunciator	145.7	775.1	.1	.4
text vs. annunciator	-152.2	775.1	.1	.4

Total intercommands

Kruskal-Wallis X₁ : Conditions Y₁ : Data

DF	2	
* Groups	3	
* Cases	30	
H	.3	p = .8696
H corrected for ties	.3	p = .8695
* tied groups	5	

Kruskal-Wallis X₁ : Conditions Y₁ : Data

Group:	* Cases:	Σ Rank:	Mean Rank:
mimic	10	160.5	16
text	10	161.5	16.1
annunciator	10	143	14.3

Secondary task mean response time

One Factor ANOVA X₁ : Conditions Y₁ : Data

Analysis of Variance Table

Source:	DF:	Sum Squares:	Mean Square:	F-test:
Between groups	2	1314139.1	657069.5	.9
Within groups	27	19791250.8	733009.3	p = .4198
Total	29	21105389.9		

Model II estimate of between component variance = -7594

One Factor ANOVA X₁ : Conditions Y₁ : Data

Group:	Count:	Mean:	Std. Dev.:	Std. Error:
mimic	10	674	276.4	87.4
text	10	1094.5	1271.1	401.9
annunciator	10	1138.2	712.1	225.2

One Factor ANOVA X₁ : Conditions Y₁ : Data

Comparison:	Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
mimic vs. text	-420.5	785.6	.6	1.1
mimic vs. annunciator	-464.2	785.6	.7	1.2
text vs. annunciator	-43.7	785.6	6.5E-3	.1

Secondary task errors

Kruskal-Wallis X¹ : Conditions Y¹ : Data

DF	2	
# Groups	3	
# Cases	30	
H	2.8	p = .2457
H corrected for ties	2.8	p = .243
# tied groups	2	

Kruskal-Wallis X¹ : Conditions Y¹ : Data

Group:	# Cases:	Σ Rank:	Mean Rank:
mimic	10	124.5	12.4
text	10	150.5	15.1
annunciator	10	190	19