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## Medical Image Processing with Quadtrees

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# Abstract

This study deduces that reionization began at a redshift of  $z = 17.82(+3.06, -2.4)$  and ended at a redshift of  $z = 7 \pm 1.8$ . This is calculated by directly applying the dynamics of star formation and the ionization rate of neutral hydrogen in the Inter-galactic Medium. A photometry strategy consisting of 3 multi-band surveys is proposed in order to observe Lyman Break Galaxies across redshifts 6–17. The surveys will locate  $100.5 \pm 37.0$ ,  $138.7 \pm 100.6$ ,  $358.1 \pm 158.6$  galaxies in redshift ranges 6–8.5, 8.5–10 and 10–17 respectively. These surveys will be completed by the James Webb Space Telescope and Euclid which are planned for launch in the coming decade. A follow up spectroscopy survey will be used to confirm the redshift and properties of 24, 4 and 48 galaxies in these 3 surveys respectively. The spectroscopy will be carried out using James Webb Space Telescope and a combination of single and multi-slit spectroscopy. It is shown that the use of known gravitational lenses, located between redshift 0.5–0.7, is very beneficial for discovering high redshift candidates as it can increase the depth of surveys by up to 3 magnitudes.

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## Part I

# Intro

## 1 Introduction

## 2 Section

### 2.1 Subsection

## Part II

# Part

## 1 section

Far out in the uncharted backwaters of the unfashionable end of the western spiral arm of the Galaxy lies a small unregarded yellow sun.

Orbiting this at a distance of roughly ninety-two million miles is an utterly insignificant little blue green planet whose ape-descended life forms are so amazingly primitive that they still think digital watches are a pretty neat idea.

This planet has - or rather had - a problem, which was this: most of the people on it were unhappy for pretty much of the time. Many solutions were suggested for this problem, but most of these were largely concerned with the movements of small green pieces of paper, which is odd because on the whole it wasn't the small green pieces of paper that were unhappy.

And so the problem remained; lots of the people were mean, and most of them were miserable, even the ones with digital watches.

Many were increasingly of the opinion that they'd all made a big mistake in coming down

from the trees in the first place. And some said that even the trees had been a bad move, and that no one should ever have left the oceans.

And then, one Thursday, nearly two thousand years after one man had been nailed to a tree for saying how great it would be to be nice to people for a change, one girl sitting on her own in a small cafe in Rickmansworth suddenly realized what it was that had been going wrong all this time, and she finally knew how the world could be made a good and happy place. This time it was right, it would work, and no one would have to get nailed to anything.

Sadly, however, before she could get to a phone to tell anyone- about it, a terribly stupid catastrophe occurred, and the idea was lost forever.

This is not her story.

But it is the story of that terrible stupid catastrophe and some of its consequences.

It is also the story of a book, a book called *The Hitch Hiker's Guide to the Galaxy* - not an Earth book, never published on Earth, and until the terrible catastrophe occurred, never seen or heard of by any Earthman.

Nevertheless, a wholly remarkable book.

in fact it was probably the most remarkable book ever to come out of the great publishing houses of Ursa Minor - of which no Earthman had ever heard either.

Not only is it a wholly remarkable book, it is also a highly successful one - more popular than the *Celestial Home Care Omnibus*, better selling than *Fifty More Things to do in Zero Gravity*, and more controversial than Oolon Colluphid's trilogy of philosophical blockbusters *Where God Went Wrong*, *Some More of God's Greatest Mistakes* and *Who is this God Person Anyway?*

In many of the more relaxed civilizations on the Outer Eastern Rim of the Galaxy, the *Hitch Hiker's Guide* has already supplanted the great *Encyclopedia Galactica* as the standard reposi-

tory of all knowledge and wisdom, for though it has many omissions and contains much that is apocryphal, or at least wildly inaccurate, it scores over the older, more pedestrian work in two important respects.

First, it is slightly cheaper; and secondly it has the words Don't Panic inscribed in large friendly letters on its cover.

But the story of this terrible, stupid Thursday, the story of its extraordinary consequences, and the story of how these consequences are inextricably intertwined with this remarkable book begins very simply.

It begins with a house.

The house stood on a slight rise just on the edge of the village. It stood on its own and looked over a broad spread of West Country farmland. Not a remarkable house by any means - it was about thirty years old, squattish, squarish, made of brick, and had four windows set in the front of a size and proportion which more or less exactly failed to please the eye.

The only person for whom the house was in any way special was Arthur Dent, and that was only because it happened to be the one he lived in. He had lived in it for about three years, ever since he had moved out of London because it made him nervous and irritable. He was about thirty as well, dark haired and never quite at ease with himself. The thing that used to worry him most was the fact that people always used to ask him what he was looking so worried about. He worked in local radio which he always used to tell his friends was a lot more interesting than they probably thought. It was, too - most of his friends worked in advertising.

It hadn't properly registered with Arthur that the council wanted to knock down his house and build an bypass instead.

At eight o'clock on Thursday morning Arthur didn't feel very good. He woke up blearily, got up, wandered blearily round his room, opened a window, saw a bulldozer, found his slippers, and stomped off to the bathroom to

wash.

Toothpaste on the brush - so. Scrub.

Shaving mirror - pointing at the ceiling. He adjusted it. For a moment it reflected a second bulldozer through the bathroom window. Properly adjusted, it reflected Arthur Dent's bristles. He shaved them off, washed, dried, and stomped off to the kitchen to find something pleasant to put in his mouth.

Kettle, plug, fridge, milk, coffee. Yawn.

The word bulldozer wandered through his mind for a moment in search of something to connect with.

The bulldozer outside the kitchen window was quite a big one.

He stared at it.

"Yellow," he thought and stomped off back to his bedroom to get dressed.

Passing the bathroom he stopped to drink a large glass of water, and another. He began to suspect that he was hung over. Why was he hung over? Had he been drinking the night before? He supposed that he must have been. He caught a glint in the shaving mirror. "Yellow," he thought and stomped on to the bedroom.

He stood and thought. The pub, he thought. Oh dear, the pub. He vaguely remembered being angry, angry about something that seemed important. He'd been telling people about it, telling people about it at great length, he rather suspected: his clearest visual recollection was of glazed looks on other people's faces. Something about a new bypass he had just found out about. It had been in the pipeline for months only no one seemed to have known about it. Ridiculous. He took a swig of water. It would sort itself out, he'd decided, no one wanted a bypass, the council didn't have a leg to stand on. It would sort itself out.

God what a terrible hangover it had earned him though. He looked at himself in the wardrobe mirror. He stuck out his tongue. "Yellow," he thought. The word yellow wandered through

his mind in search of something to connect with.

Fifteen seconds later he was out of the house and lying in front of a big yellow bulldozer that was advancing up his garden path. Mr L Prosser was, as they say, only human. In other words he was a carbon-based life form descended from an ape. More specifically he was forty, fat and shabby and worked for the local council. Curiously enough, though he didn't know it, he was also a direct male-line descendant of Genghis Khan, though intervening generations and racial mixing had so juggled his genes that he had no discernible Mongoloid characteristics, and the only vestiges left in Mr L Prosser of his mighty ancestry were a pronounced stoutness about the tum and a predilection for little fur hats.

He was by no means a great warrior: in fact he was a nervous worried man. Today he was particularly nervous and worried because something had gone seriously wrong with his job - which was to see that Arthur Dent's house got cleared out of the way before the day was out.

"Come off it, Mr Dent," he said, "you can't win you know. You can't lie in front of the bulldozer indefinitely." He tried to make his eyes blaze fiercely but they just wouldn't do it.

Arthur lay in the mud and squelched at him.

"I'm game," he said, "we'll see who rusts first."

"I'm afraid you're going to have to accept it," said Mr Prosser gripping his fur hat and rolling it round the top of his head, "this bypass has got to be built and it's going to be built!"

"First I've heard of it," said Arthur, "why's it going to be built?"

Mr Prosser shook his finger at him for a bit, then stopped and put it away again.

"What do you mean, why's it got to be built?"

he said. "It's a bypass. You've got to build bypasses."

Bypasses are devices which allow some people to drive from point A to point B very fast whilst other people dash from point B to point A very fast. People living at point C, being a point directly in between, are often given to wonder what's so great about point A that so many people of point B are so keen to get there, and what's so great about point B that so many people of point A are so keen to get there. They often wish that people would just once and for all work out where the hell they wanted to be.

Mr Prosser wanted to be at point D. Point D wasn't anywhere in particular, it was just any convenient point a very long way from points A, B and C. He would have a nice little cottage at point D, with axes over the door, and spend a pleasant amount of time at point E, which would be the nearest pub to point D. His wife of course wanted climbing roses, but he wanted axes. He didn't know why - he just liked axes. He flushed hotly under the derisive grins of the bulldozer drivers.

He shifted his weight from foot to foot, but it was equally uncomfortable on each. Obviously somebody had been appallingly incompetent and he hoped to God it wasn't him.

Mr Prosser said: "You were quite entitled to make any suggestions or protests at the appropriate time you know."

"Appropriate time?" hooted Arthur. "Appropriate time? The first I knew about it was when a workman arrived at my home yesterday. I asked him if he'd come to clean the windows and he said no he'd come to demolish the house. He didn't tell me straight away of course. Oh no. First he wiped a couple of windows and charged me a fiver. Then he told me."

"But Mr Dent, the plans have been available in the local planning office for the last nine months."

"Oh yes, well as soon as I heard I went straight round to see them, yesterday afternoon. You

hadn't exactly gone out of your way to call attention to them had you? I mean like actually telling anybody or anything."

"But the plans were on display ..."

"On display? I eventually had to go down to the cellar to find them."

"That's the display department."

"With a torch."

"Ah, well the lights had probably gone."

"So had the stairs."

"But look, you found the notice didn't you?"

"Yes," said Arthur, "yes I did. It was on display in the bottom of a locked filing cabinet stuck in a disused lavatory with a sign on the door saying Beware of the Leopard."

A cloud passed overhead. It cast a shadow over Arthur Dent as he lay propped up on his elbow in the cold mud. It cast a shadow over Arthur Dent's house. Mr Prosser frowned at it.

"It's not as if it's a particularly nice house," he said.

"I'm sorry, but I happen to like it."

"You'll like the bypass."

"Oh shut up," said Arthur Dent. "Shut up and go away, and take your bloody bypass with you. You haven't got a leg to stand on and you know it."

Mr Prosser's mouth opened and closed a couple of times while his mind was for a moment filled with inexplicable but terribly attractive visions of Arthur Dent's house being consumed with fire and Arthur himself running screaming from the blazing ruin with at least three hefty spears protruding from his back. Mr Prosser was often bothered with visions like these and they made him feel very nervous. He stuttered for a moment and then pulled himself together.

"Mr Dent," he said.

"Hello? Yes?" said Arthur.

"Some factual information for you. Have you any idea how much damage that bulldozer would suffer if I just let it roll straight over you?"

"How much?" said Arthur.

"None at all," said Mr Prosser, and stormed nervously off wondering why his brain was filled with a thousand hairy horsemen all shouting at him.

By a curious coincidence, None at all is exactly how much suspicion the ape-descendant Arthur Dent had that one of his closest friends was not descended from an ape, but was in fact from a small planet in the vicinity of Betelgeuse and not from Guildford as he usually claimed.

Arthur Dent had never, ever suspected this.

This friend of his had first arrived on the planet some fifteen Earth years previously, and he had worked hard to blend himself into Earth society - with, it must be said, some success. For instance he had spent those fifteen years pretending to be an out of work actor, which was plausible enough.

He had made one careless blunder though, because he had skimmed a bit on his preparatory research. The information he had gathered had led him to choose the name "Ford Prefect" as being nicely inconspicuous.

He was not conspicuously tall, his features were striking but not conspicuously handsome. His hair was wiry and gingerish and brushed backwards from the temples. His skin seemed to be pulled backwards from the nose. There was something very slightly odd about him, but it was difficult to say what it was. Perhaps it was that his eyes didn't blink often enough and when you talked to him for any length of time your eyes began involuntarily to water on his behalf. Perhaps it was that he smiled slightly too broadly and gave people the unnerving impression that he was about to go for their neck.

He struck most of the friends he had made on

Earth as an eccentric, but a harmless one – an unruly boozier with some oddish habits. For instance he would often gatecrash university parties, get badly drunk and start making fun of any astrophysicist he could find till he got thrown out.

Sometimes he would get seized with oddly distracted moods and stare into the sky as if hypnotized until someone asked him what he was doing. Then he would start guiltily for a moment, relax and grin. "Oh, just looking for flying saucers," he would joke and everyone would laugh and ask him what sort of flying saucers he was looking for.

"Green ones!" he would reply with a wicked grin, laugh wildly for a moment and then suddenly lunge for the nearest bar and buy an enormous round of drinks.

Evenings like this usually ended badly. Ford would get out of his skull on whisky, huddle into a corner with some girl and explain to her in slurred phrases that honestly the colour of the flying saucers didn't matter that much really.

Thereafter, staggering semi-paralytic down the night streets he would often ask passing policemen if they knew the way to Betelgeuse. The policemen would usually say something like, "Don't you think it's about time you went off home sir?"

"I'm trying to baby, I'm trying to," is what Ford invariably replied on these occasions.

In fact what he was really looking out for when he stared distractedly into the night sky was any kind of flying saucer at all. The reason he said green was that green was the traditional space livery of the Betelgeuse trading scouts.

Ford Prefect was desperate that any flying saucer at all would arrive soon because fifteen years was a long time to get stranded anywhere, particularly somewhere as mindbogglingly dull as the Earth.

Ford wished that a flying saucer would arrive soon because he knew how to flag flying saucers

down and get lifts from them. He knew how to see the Marvels of the Universe for less than thirty Altairan dollars a day.

In fact, Ford Prefect was a roving researcher for that wholly remarkable book *The Hitch Hiker's Guide to the Galaxy*.

Human beings are great adaptors, and by lunchtime life in the environs of Arthur's house had settled into a steady routine. It was Arthur's accepted role to lie squelching in the mud making occasional demands to see his lawyer, his mother or a good book; it was Mr Prosser's accepted role to tackle Arthur with the occasional new ploy such as the For the Public Good talk, the March of Progress talk, the They Knocked My House Down Once You Know, Never Looked Back talk and various other cajoleries and threats; and it was the bulldozer drivers' accepted role to sit around drinking coffee and experimenting with union regulations to see how they could turn the situation to their financial advantage.

The Earth moved slowly in its diurnal course.

The sun was beginning to dry out the mud Arthur lay in.

A shadow moved across him again.

"Hello Arthur," said the shadow. Arthur looked up and squinting into the sun was startled to see Ford Prefect standing above him.

"Ford! Hello, how are you?"

"Fine," said Ford, "look, are you busy?"

"Am I busy?" exclaimed Arthur. "Well, I've just got all these bulldozers and things to lie in front of because they'll knock my house down if I don't, but other than that ... well, no not especially, why?"

They don't have sarcasm on Betelgeuse, and Ford Prefect often failed to notice it unless he was concentrating. He said, "Good, is there anywhere we can talk?"

"What?" said Arthur Dent.



For a few seconds Ford seemed to ignore him, and stared fixedly into the sky like a rabbit trying to get run over by a car. Then suddenly he squatted down beside Arthur.

"We've got to talk," he said urgently.

"Fine," said Arthur, "talk."

"And drink," said Ford. "It's vitally important that we talk and drink. Now. We'll go to the pub in the village."

He looked into the sky again, nervous, expectant.

"Look, don't you understand?" shouted Arthur. He pointed at Prosser. "That man wants to knock my house down!"

Ford glanced at him, puzzled.

"Well he can do it while you're away can't he?" he asked.

"But I don't want him to!"

"Ah."

"Look, what's the matter with you Ford?" said Arthur.

"Nothing. Nothing's the matter. Listen to me - I've got to tell you the most important thing you've ever heard. I've got to tell you now, and I've got to tell you in the saloon bar of the Horse and Groom."

"But why?"

"Because you are going to need a very stiff drink."

Ford stared at Arthur, and Arthur was astonished to find that his will was beginning to weaken. He didn't realize that this was because of an old drinking game that Ford learned to play in the hyperspace ports that served the madranite mining belts in the star system of Orion Beta. The game was not unlike the Earth game called Indian Wrestling, and was played like this:

Two contestants would sit either side of a table, with a glass in front of each of them.

Between them would be placed a bottle of Janx Spirit (as immortalized in that ancient Orion mining song "Oh don't give me none more of that Old Janx Spirit/ No, don't you give me none more of that Old Janx Spirit/ For my head will fly, my tongue will lie, my eyes will fry and I may die/ Won't you pour me one more of that sinful Old Janx Spirit").

Each of the two contestants would then concentrate their will on the bottle and attempt to tip it and pour spirit into the glass of his opponent - who would then have to drink it.

The bottle would then be refilled. The game would be played again. And again.

Once you started to lose you would probably keep losing, because one of the effects of Janx spirit is to depress telepsychic power.

As soon as a predetermined quantity had been consumed, the final loser would have to perform a forfeit, which was usually obscenely biological.

Ford Prefect usually played to lose.

Ford stared at Arthur, who began to think that perhaps he did want to go to the Horse and Groom after all.

"But what about my house ...?" he asked plaintively.

Ford looked across to Mr Prosser, and suddenly a wicked thought struck him.

"He wants to knock your house down?"

"Yes, he wants to build ..."

"And he can't because you're lying in front of the bulldozers?"

"Yes, and ..."

"I'm sure we can come to some arrangement," said Ford. "Excuse me!" he shouted.

Mr Prosser (who was arguing with a spokesman for the bulldozer drivers about whether or not Arthur Dent constituted a mental health hazard, and how much they should get paid if he did) looked around. He was surprised and

slightly alarmed to find that Arthur had company.

"Yes? Hello?" he called. "Has Mr Dent come to his senses yet?"

"Can we for the moment," called Ford, "assume that he hasn't?" "Well?" sighed Mr Prosser.

"And can we also assume," said Ford, "that he's going to be staying here all day?"

"So?"

"So all your men are going to be standing around all day doing nothing?"

"Could be, could be ..."

"Well, if you're resigned to doing that anyway, you don't actually need him to lie here all the time do you?"

"What?"

"You don't," said Ford patiently, "actually need him here."

Mr Prosser thought about this.

"Well no, not as such..." he said, "not exactly need ..." Prosser was worried. He thought that one of them wasn't making a lot of sense.

Ford said, "So if you would just like to take it as read that he's actually here, then he and I could slip off down to the pub for half an hour. How does that sound?"

Mr Prosser thought it sounded perfectly potty.

"That sounds perfectly reasonable," he said in a reassuring tone of voice, wondering who he was trying to reassure.

"And if you want to pop off for a quick one yourself later on," said Ford, "we can always cover up for you in return."

"Thank you very much," said Mr Prosser who no longer knew how to play this at all, "thank you very much, yes, that's very kind ..." He frowned, then smiled, then tried to do both at once, failed, grasped hold of his fur hat and

rolled it fitfully round the top of his head. He could only assume that he had just won.

"So," continued Ford Prefect, "if you would just like to come over here and lie down ..."

"What?" said Mr Prosser.

"Ah, I'm sorry," said Ford, "perhaps I hadn't made myself fully clear. Somebody's got to lie in front of the bulldozers haven't they? Or there won't be anything to stop them driving into Mr Dent's house will there?"

"What?" said Mr Prosser again.

"It's very simple," said Ford, "my client, Mr Dent, says that he will stop lying here in the mud on the sole condition that you come and take over from him." "What are you talking about?" said Arthur, but Ford nudged him with his shoe to be quiet.

"You want me," said Mr Prosser, spelling out this new thought to himself, "to come and lie there ..."

"Yes."

"In front of the bulldozer?"

"Yes."

"Instead of Mr Dent."

"Yes."

"In the mud."

"In, as you say it, the mud."

As soon as Mr Prosser realized that he was substantially the loser after all, it was as if a weight lifted itself off his shoulders: this was more like the world as he knew it. He sighed.

"In return for which you will take Mr Dent with you down to the pub?"

"That's it," said Ford. "That's it exactly."

Mr Prosser took a few nervous steps forward and stopped.

"Promise?"

"Promise," said Ford. He turned to Arthur.

"Come on," he said to him, "get up and let the man lie down."

Arthur stood up, feeling as if he was in a dream.

Ford beckoned to Prosser who sadly, awkwardly, sat down in the mud. He felt that his whole life was some kind of dream and he sometimes wondered whose it was and whether they were enjoying it. The mud folded itself round his bottom and his arms and oozed into his shoes.

Ford looked at him severely.

"And no sneaky knocking down Mr Dent's house whilst he's away, alright?" he said.

"The mere thought," growled Mr Prosser, "hadn't even begun to speculate," he continued, settling himself back, "about the merest possibility of crossing my mind."

He saw the bulldozer driver's union representative approaching and let his head sink back and closed his eyes. He was trying to marshal his arguments for proving that he did not now constitute a mental health hazard himself. He was far from certain about this - his mind seemed to be full of noise, horses, smoke, and the stench of blood. This always happened when he felt miserable and put upon, and he had never been able to explain it to himself. In a high dimension of which we know nothing the mighty Khan bellowed with rage, but Mr Prosser only trembled slightly and whimpered. He began to feel little pricks of water behind the eyelids. Bureaucratic cock-ups, angry men lying in the mud, indecipherable strangers handing out inexplicable humiliations and an unidentified army of horsemen laughing at him in his head - what a day.

What a day. Ford Prefect knew that it didn't matter a pair of dingo's kidneys whether Arthur's house got knocked down or not now.

Arthur remained very worried.

"But can we trust him?" he said.

"Myself I'd trust him to the end of the Earth," said Ford.

"Oh yes," said Arthur, "and how far's that?"

"About twelve minutes away," said Ford, "come on, I need a drink."

Here's what the Encyclopedia Galactica has to say about alcohol. It says that alcohol is a colourless volatile liquid formed by the fermentation of sugars and also notes its intoxicating effect on certain carbon-based life forms.

The Hitch Hiker's Guide to the Galaxy also mentions alcohol. It says that the best drink in existence is the Pan Galactic Gargle Blaster.

It says that the effect of a Pan Galactic Gargle Blaster is like having your brains smashed out by a slice of lemon wrapped round a large gold brick.

The Guide also tells you on which planets the best Pan Galactic Gargle Blasters are mixed, how much you can expect to pay for one and what voluntary organizations exist to help you rehabilitate afterwards.

The Guide even tells you how you can mix one yourself.

Take the juice from one bottle of that Ol' Janx Spirit, it says.

Pour into it one measure of water from the seas of Santraginus V - Oh that Santraginean sea water, it says. Oh those Santraginean fish!!!

Allow three cubes of Arcturan Mega-gin to melt into the mixture (it must be properly iced or the benzine is lost).

Allow four litres of Fallian marsh gas to bubble through it, in memory of all those happy Hikers who have died of pleasure in the Marshes of Fallia.

Over the back of a silver spoon float a measure of Qualactin Hypermint extract, redolent of all

the heady odours of the dark Qualactin Zones, subtle sweet and mystic.

Drop in the tooth of an Algolian Suntiger. Watch it dissolve, spreading the fires of the Algolian Suns deep into the heart of the drink.

Sprinkle Zamphuor.

Add an olive.

Drink ... but ... very carefully ...

The Hitch Hiker's Guide to the Galaxy sells rather better than the Encyclopedia Galactica.

"Six pints of bitter," said Ford Prefect to the barman of the Horse and Groom. "And quickly please, the world's about to end."

The barman of the Horse and Groom didn't deserve this sort of treatment, he was a dignified old man. He pushed his glasses up his nose and blinked at Ford Prefect. Ford ignored him and stared out of the window, so the barman looked instead at Arthur who shrugged helplessly and said nothing.

So the barman said, "Oh yes sir? Nice weather for it," and started pulling pints.

He tried again.

"Going to watch the match this afternoon then?"

Ford glanced round at him.

"No, no point," he said, and looked back out of the window.

"What's that, foregone conclusion then you reckon sir?" said the barman. "Arsenal without a chance?"

"No, no," said Ford, "it's just that the world's about to end."

"Oh yes sir, so you said," said the barman, looking over his glasses this time at Arthur. "Lucky escape for Arsenal if it did."

Ford looked back at him, genuinely surprised.

"No, not really," he said. He frowned.

The barman breathed in heavily. "There you are sir, six pints," he said.

Arthur smiled at him wanly and shrugged again. He turned and smiled wanly at the rest of the pub just in case any of them had heard what was going on. None of them had, and none of them could understand what he was smiling at them for.

A man sitting next to Ford at the bar looked at the two men, looked at the six pints, did a swift burst of mental arithmetic, arrived at an answer he liked and grinned a stupid hopeful grin at them.

"Get off," said Ford, "They're ours," giving him a look that would have an Algolian Suntiger get on with what it was doing.

Ford slapped a five-pound note on the bar. He said, "Keep the change."

"What, from a fiver? Thank you sir."

"You've got ten minutes left to spend it."

The barman simply decided to walk away for a bit.

"Ford," said Arthur, "would you please tell me what the hell is going on?"

"Drink up," said Ford, "you've got three pints to get through."

"Three pints?" said Arthur. "At lunchtime?"

The man next to Ford grinned and nodded happily. Ford ignored him. He said, "Time is an illusion. Lunchtime doubly so."

"Very deep," said Arthur, "you should send that in to the Reader's Digest. They've got a page for people like you."

"Drink up."

"Why three pints all of a sudden?"

"Muscle relaxant, you'll need it."

"Muscle relaxant?"

"Muscle relaxant."

Arthur stared into his beer.

"Did I do anything wrong today," he said, "or has the world always been like this and I've been too wrapped up in myself to notice?"

"Alright," said Ford, "I'll try to explain. How long have we known each other?"

"How long?" Arthur thought. "Er, about five years, maybe six," he said. "Most of it seemed to make some sense at the time."

"Alright," said Ford. "How would you react if I said that I'm not from Guildford after all, but from a small planet somewhere in the vicinity of Betelgeuse?" Arthur shrugged in a so-so sort of way.

"I don't know," he said, taking a pull of beer. "Why - do you think it's the sort of thing you're likely to say?"

Ford gave up. It really wasn't worth bothering at the moment, what with the world being about to end. He just said:

"Drink up."

He added, perfectly factually:

"The world's about to end."

Arthur gave the rest of the pub another wan smile. The rest of the pub frowned at him. A man waved at him to stop smiling at them and mind his own business.

"This must be Thursday," said Arthur musing to himself, sinking low over his beer, "I never could get the hang of Thursdays."

On this particular Thursday, something was moving quietly through the ionosphere many miles above the surface of the planet; several somethings in fact, several dozen huge yellow chunky slablike somethings, huge as office buildings, silent as birds. They soared with ease, basking in electromagnetic rays from the star Sol, biding their time, grouping, preparing.

The planet beneath them was almost perfectly oblivious of their presence, which was just how

they wanted it for the moment. The huge yellow somethings went unnoticed at Goonhilly, they passed over Cape Canaveral without a blip, Woomera and Jodrell Bank looked straight through them - which was a pity because it was exactly the sort of thing they'd been looking for all these years.

The only place they registered at all was on a small black device called a Sub-Etha Sens-O-Matic which winked away quietly to itself. It nestled in the darkness inside a leather satchel which Ford Prefect wore habitually round his neck. The contents of Ford Prefect's satchel were quite interesting in fact and would have made any Earth physicist's eyes pop out of his head, which is why he always concealed them by keeping a couple of dog-eared scripts for plays he pretended he was auditioning for stuffed in the top. Besides the Sub-Etha Sens-O-Matic and the scripts he had an Electronic Thumb - a short squat black rod, smooth and matt with a couple of flat switches and dials at one end; he also had a device which looked rather like a largish electronic calculator. This had about a hundred tiny flat press buttons and a screen about four inches square on which any one of a million "pages" could be summoned at a moment's notice. It looked insanely complicated, and this was one of the reasons why the snug plastic cover it fitted into had the words Don't Panic printed on it in large friendly letters. The other reason was that this device was in fact that most remarkable of all books ever to come out of the great publishing corporations of Ursa Minor - The Hitch Hiker's Guide to the Galaxy. The reason why it was published in the form of a micro sub meson electronic component is that if it were printed in normal book form, an interstellar hitch hiker would require several inconveniently large buildings to carry it around in.

Beneath that in Ford Prefect's satchel were a few biros, a notepad, and a largish bath towel from Marks and Spencer.

The Hitch Hiker's Guide to the Galaxy has a few things to say on the subject of towels.

A towel, it says, is about the most massively useful thing an interstellar hitch hiker can have. Partly it has great practical value - you can wrap it around you for warmth as you bound across the cold moons of Jaglan Beta; you can lie on it on the brilliant marble-sanded beaches of Santruginus V, inhaling the heady sea vapours; you can sleep under it beneath the stars which shine so redly on the desert world of Kakrafoon; use it to sail a mini raft down the slow heavy river Moth; wet it for use in hand-to-hand-combat; wrap it round your head to ward off noxious fumes or to avoid the gaze of the Ravenous Bugblatter Beast of Traal (a mindboggingly stupid animal, it assumes that if you can't see it, it can't see you - daft as a bush, but very ravenous); you can wave your towel in emergencies as a distress signal, and of course dry yourself off with it if it still seems to be clean enough.

More importantly, a towel has immense psychological value. For some reason, if a strag (strag: non-hitch hiker) discovers that a hitch hiker has his towel with him, he will automatically assume that he is also in possession of a toothbrush, face flannel, soap, tin of biscuits, flask, compass, map, ball of string, gnat spray, wet weather gear, space suit etc., etc. Furthermore, the strag will then happily lend the hitch hiker any of these or a dozen other items that the hitch hiker might accidentally have "lost". What the strag will think is that any man who can hitch the length and breadth of the galaxy, rough it, slum it, struggle against terrible odds, win through, and still knows where his towel is is clearly a man to be reckoned with.

Hence a phrase which has passed into hitch hiking slang, as in "Hey, you sass that hoopy Ford Prefect? There's a frood who really knows where his towel is." (Sass: know, be aware of, meet, have sex with; hoopy: really together guy; frood: really amazingly together guy.)

Nestling quietly on top of the towel in Ford Prefect's satchel, the Sub-Etha Sens-O-Matic began to wink more quickly. Miles above the surface of the planet the huge yellow somethings began to fan out. At Jodrell Bank, someone

decided it was time for a nice relaxing cup of tea.

"You got a towel with you?" said Ford Prefect suddenly to Arthur.

Arthur, struggling through his third pint, looked round at him.

"Why? What, no ... should I have?" He had given up being surprised, there didn't seem to be any point any longer.

Ford clicked his tongue in irritation.

"Drink up," he urged.

At that moment the dull sound of a rumbling crash from outside filtered through the low murmur of the pub, through the sound of the juke-box, through the sound of the man next to Ford hiccupping over the whisky Ford had eventually bought him.

Arthur choked on his beer, leapt to his feet.

"What's that?" he yelped.

"Don't worry," said Ford, "they haven't started yet."

"Thank God for that," said Arthur and relaxed.

"It's probably just your house being knocked down," said Ford, drowning his last pint.

"What?" shouted Arthur. Suddenly Ford's spell was broken. Arthur looked wildly around him and ran to the window.

"My God they are! They're knocking my house down. What the hell am I doing in the pub, Ford?"

"It hardly makes any difference at this stage," said Ford, "let them have their fun."

"Fun?" yelped Arthur. "Fun!" He quickly checked out of the window again that they were talking about the same thing.

"Damn their fun!" he hooted and ran out of the pub furiously waving a nearly empty beer glass. He made no friends at all in the pub that lunchtime.

"Stop, you vandals! You home wreckers!" bawled Arthur. "You half crazed Visigoths, stop will you!"

Ford would have to go after him. Turning quickly to the barman he asked for four packets of peanuts.

"There you are sir," said the barman, slapping the packets on the bar, "twenty-eight pence if you'd be so kind."

Ford was very kind - he gave the barman another five-pound note and told him to keep the change. The barman looked at it and then looked at Ford. He suddenly shivered: he experienced a momentary sensation that he didn't understand because no one on Earth had ever experienced it before. In moments of great stress, every life form that exists gives out a tiny subliminal signal. This signal simply communicates an exact and almost pathetic sense of how far that being is from the place of his birth. On Earth it is never possible to be further than sixteen thousand miles from your birthplace, which really isn't very far, so such signals are too minute to be noticed. Ford Prefect was at this moment under great stress, and he was born 600 light years away in the near vicinity of Betelgeuse.

The barman reeled for a moment, hit by a shocking, incomprehensible sense of distance. He didn't know what it meant, but he looked at Ford Prefect with a new sense of respect, almost awe.

"Are you serious, sir?" he said in a small whisper which had the effect of silencing the pub. "You think the world's going to end?"

"Yes," said Ford.

"But, this afternoon?"

Ford had recovered himself. He was at his flippest.

"Yes," he said gaily, "in less than two minutes I would estimate."

The barman couldn't believe the conversation he was having, but he couldn't believe the sensation he had just had either.

"Isn't there anything we can do about it then?" he said.

"No, nothing," said Ford, stuffing the peanuts into his pockets.

Someone in the hushed bar suddenly laughed raucously at how stupid everyone had become.

The man sitting next to Ford was a bit sozzled by now. His eyes waved their way up to Ford.

"I thought," he said, "that if the world was going to end we were meant to lie down or put a paper bag over our head or something."

"If you like, yes," said Ford.

"That's what they told us in the army," said the man, and his eyes began the long trek back down to his whisky.

"Will that help?" asked the barman.

"No," said Ford and gave him a friendly smile. "Excuse me," he said, "I've got to go." With a wave, he left.

The pub was silent for a moment longer, and then, embarrassingly enough, the man with the raucous laugh did it again. The girl he had dragged along to the pub with him had grown to loathe him dearly over the last hour or so, and it would probably have been a great satisfaction to her to know that in a minute and a half or so he would suddenly evaporate into a whiff of hydrogen, ozone and carbon monoxide. However, when the moment came she would be too busy evaporating herself to notice it.

The barman cleared his throat. He heard himself say:

"Last orders, please." The huge yellow machines began to sink downward and to move faster.

Ford knew they were there. This wasn't the way he had wanted it.

Running up the lane, Arthur had nearly reached his house. He didn't notice how cold it had suddenly become, he didn't notice the

wind, he didn't notice the sudden irrational squall of rain. He didn't notice anything but the caterpillar bulldozers crawling over the rubble that had been his home.

"You barbarians!" he yelled. "I'll sue the council for every penny it's got! I'll have you hung, drawn and quartered! And whipped! And boiled ... until ... until ... until you've had enough."

Ford was running after him very fast. Very very fast.

"And then I'll do it again!" yelled Arthur. "And when I've finished I will take all the little bits, and I will jump on them!"

Arthur didn't notice that the men were running from the bulldozers; he didn't notice that Mr Prosser was staring hectically into the sky. What Mr Prosser had noticed was that huge yellow somethings were screaming through the clouds. Impossibly huge yellow somethings.

"And I will carry on jumping on them," yelled Arthur, still running, "until I get blisters, or I can think of anything even more unpleasant to do, and then ..."

Arthur tripped, and fell headlong, rolled and landed flat on his back. At last he noticed that something was going on. His finger shot upwards.

"What the hell's that?" he shrieked.

Whatever it was raced across the sky in monstrous yellowness, tore the sky apart with mind-boggling noise and leapt off into the distance leaving the gaping air to shut behind it with a bang that drove your ears six feet into your skull.

Another one followed and did the same thing only louder.

It's difficult to say exactly what the people on the surface of the planet were doing now, because they didn't really know what they were doing themselves. None of it made a lot of sense - running into houses, running out of houses, howling noiselessly at the noise. All

around the world city streets exploded with people, cars slewed into each other as the noise fell on them and then rolled off like a tidal wave over hills and valleys, deserts and oceans, seeming to flatten everything it hit.

Only one man stood and watched the sky, stood with terrible sadness in his eyes and rubber bungs in his ears. He knew exactly what was happening and had known ever since his Sub-Etha Sens-O- Matic had started winking in the dead of night beside his pillar and woken him with a start. It was what he had waited for all these years, but when he had deciphered the signal pattern sitting alone in his small dark room a coldness had gripped him and squeezed his heart. Of all the races in all of the Galaxy who could have come and said a big hello to planet Earth, he thought, didn't it just have to be the Vogons.

Still he knew what he had to do. As the Vagon craft screamed through the air high above him he opened his satchel. He threw away a copy of Joseph and the Amazing Technicolor Dreamcoat, he threw away a copy of Godspell: He wouldn't need them where he was going. Everything was ready, everything was prepared.

He knew where his towel was.

A sudden silence hit the Earth. If anything it was worse than the noise. For a while nothing happened.

The great ships hung motionless in the air, over every nation on Earth. Motionless they hung, huge, heavy, steady in the sky, a blasphemy against nature. Many people went straight into shock as their minds tried to encompass what they were looking at. The ships hung in the sky in much the same way that bricks don't.

And still nothing happened.

Then there was a slight whisper, a sudden spacious whisper of open ambient sound. Every hi fi set in the world, every radio, every television, every cassette recorder, every woofer, every tweeter, every mid-range driver in the world quietly turned itself on.



Every tin can, every dust bin, every window, every car, every wine glass, every sheet of rusty metal became activated as an acoustically perfect sounding board.

Before the Earth passed away it was going to be treated to the very ultimate in sound reproduction, the greatest public address system ever built. But there was no concert, no music, no fanfare, just a simple message.

"People of Earth, your attention please," a voice said, and it was wonderful. Wonderful perfect quadrophonic sound with distortion levels so low as to make a brave man weep.

"This is Prostetnic Vogon Jeltz of the Galactic Hyperspace Planning Council," the voice continued. "As you will no doubt be aware, the plans for development of the outlying regions of the Galaxy require the building of a hyperspatial express route through your star system, and regrettably your planet is one of those scheduled for demolition. The process will take slightly less than two of your Earth minutes. Thank you."

The PA died away.

Uncomprehending terror settled on the watching people of Earth. The terror moved slowly through the gathered crowds as if they were iron fillings on a sheet of board and a magnet was moving beneath them. Panic sprouted again, desperate fleeing panic, but there was nowhere to flee to. Observing this, the Vogons turned on their PA again. It said:

"There's no point in acting all surprised about it. All the planning charts and demolition orders have been on display in your local planning department on Alpha Centauri for fifty of your Earth years, so you've had plenty of time to lodge any formal complaint and it's far too late to start making a fuss about it now."

The PA fell silent again and its echo drifted off across the land. The huge ships turned slowly in the sky with easy power. On the underside of each a hatchway opened, an empty black space.

By this time somebody somewhere must have

manned a radio transmitter, located a wavelength and broadcasted a message back to the Vogon ships, to plead on behalf of the planet. Nobody ever heard what they said, they only heard the reply. The PA slammed back into life again. The voice was annoyed. It said:

"What do you mean you've never been to Alpha Centauri? For heaven's sake mankind, it's only four light years away you know. I'm sorry, but if you can't be bothered to take an interest in local affairs that's your own lookout.

"Energize the demolition beams."

Light poured out into the hatchways.

"I don't know," said the voice on the PA, "apathetic bloody planet, I've no sympathy at all." It cut off.

There was a terrible ghastly silence.

There was a terrible ghastly noise.

There was a terrible ghastly silence.

The Vogon Constructor fleet coasted away into the inky starry void.

Far away on the opposite spiral arm of the Galaxy, five hundred thousand light years from the star Sol, Zaphod Beeblebrox, President of the Imperial Galactic Government, sped across the seas of Damogran, his ion drive delta boat winking and flashing in the Damogran sun.

Damogran the hot; Damogran the remote; Damogran the almost totally unheard of.

Damogran, secret home of the Heart of Gold.

The boat sped on across the water. It would be some time before it reached its destination because Damogran is such an inconveniently arranged planet. It consists of nothing but middling to large desert islands separated by very pretty but annoyingly wide stretches of ocean.

The boat sped on.

Because of this topological awkwardness Damogran has always remained a deserted planet. This is why the Imperial Galactic Government chose Damogran for the Heart of Gold project, because it was so deserted and the Heart of Gold was so secret.

The boat zipped and skipped across the sea, the sea that lay between the main islands of the only archipelago of any useful size on the whole planet. Zaphod Beeblebrox was on his way from the tiny spaceport on Easter Island (the name was an entirely meaningless coincidence - in Galacticspeke, easter means small flat and light brown) to the Heart of Gold island, which by another meaningless coincidence was called France.

One of the side effects of work on the Heart of Gold was a whole string of pretty meaningless coincidences.

But it was not in any way a coincidence that today, the day of culmination of the project, the great day of unveiling, the day that the Heart of Gold was finally to be introduced to a marvelling Galaxy, was also a great day of culmination for Zaphod Beeblebrox. It was for the sake of this day that he had first decided to run for the Presidency, a decision which had sent waves of astonishment throughout the Imperial Galaxy - Zaphod Beeblebrox? President? Not the Zaphod Beeblebrox? Not the President? Many had seen it as a clinching proof that the whole of known creation had finally gone bananas.

Zaphod grinned and gave the boat an extra kick of speed.

Zaphod Beeblebrox, adventurer, ex-hippy, good timer, (crook? quite possibly), manic self-publicist, terribly bad at personal relationships, often thought to be completely out to lunch.

President?

No one had gone bananas, not in that way at least.

Only six people in the entire Galaxy understood the principle on which the Galaxy was

governed, and they knew that once Zaphod Beeblebrox had announced his intention to run as President it was more or less a fait accompli: he was the ideal Presidency fodder\*.

What they completely failed to understand was why Zaphod was doing it.

He banked sharply, shooting a wild wall of water at the sun.

Today was the day; today was the day when they would realize what Zaphod had been up to. Today was what Zaphod Beeblebrox's Presidency was all about. Today was also his two hundredth birthday, but that was just another meaningless coincidence.

As he skipped his boat across the seas of Damogran he smiled quietly to himself about what a wonderful exciting day it was going to be. He relaxed and spread his two arms lazily across the seat back. He steered with an extra arm he'd recently fitted just beneath his right one to help improve his ski-boxing.

"Hey," he cooed to himself, "you're a real cool boy you." But his nerves sang a song shriller than a dog whistle.

The island of France was about twenty miles long, five miles across the middle, sandy and crescent shaped. In fact it seemed to exist not so much as an island in its own right as simply a means of defining the sweep and curve of a huge bay. This impression was heightened by the fact that the inner coastline of the crescent consisted almost entirely of steep cliffs. From the top of the cliff the land sloped slowly down five miles to the opposite shore.

On top of the cliffs stood a reception committee.

It consisted in large part of the engineers and researchers who had built the Heart of Gold - mostly humanoid, but here and there were a few reptiloid atomineers, two or three green slyph-like maximegalacticans, an octopoid physuculturalist or two and a Hoolooovoo (a Hoolooovoo is a super-intelligent shade of the color blue). All except the Hoolooovoo were resplendent in their multi-colored ceremonial lab coats; the

Hoolooovoo had been temporarily refracted into a free standing prism for the occasion.

There was a mood of immense excitement thrilling through all of them. Together and between them they had gone to and beyond the furthest limits of physical laws, restructured the fundamental fabric of matter, strained, twisted and broken the laws of possibility and impossibility, but still the greatest excitement of all seemed to be to meet a man with an orange sash round his neck. (An orange sash was what the President of the Galaxy traditionally wore.) It might not even have made much difference to them if they'd known exactly how much power the President of the Galaxy actually wielded: none at all. Only six people in the Galaxy knew that the job of the Galactic President was not to wield power but to attract attention away from it.

Zaphod Beeblebrox was amazingly good at his job.

The crowd gasped, dazzled by sun and seemannship, as the Presidential speedboat zipped round the headland into the bay. It flashed and shone as it came skating over the sea in wide skidding turns.

In fact it didn't need to touch the water at all, because it was supported on a hazy cushion of ionized atoms - but just for effect it was fitted with thin finblades which could be lowered into the water. They slashed sheets of water hissing into the air, carved deep gashes into the sea which swayed crazily and sank back foaming into the boat's wake as it careered across the bay.

Zaphod loved effect: it was what he was best at.

He twisted the wheel sharply, the boat slewed round in a wild scything skid beneath the cliff face and dropped to rest lightly on the rocking waves.

Within seconds he ran out onto the deck and waved and grinned at over three billion people. The three billion people weren't actually there, but they watched his every gesture through the

eyes of a small robot tri-D camera which hovered obsequiously in the air nearby. The antics of the President always made amazingly popular tri-D; that's what they were for.

He grinned again. Three billion and six people didn't know it, but today would be a bigger antic than anyone had bargained for.

The robot camera homed in for a close up on the more popular of his two heads and he waved again. He was roughly humanoid in appearance except for the extra head and third arm. His fair tousled hair stuck out in random directions, his blue eyes glinted with something completely unidentifiable, and his chins were almost always unshaven.

A twenty-foot-high transparent globe floated next to his boat, rolling and bobbing, glistening in the brilliant sun. Inside it floated a wide semi-circular sofa upholstered in glorious red leather: the more the globe bobbed and rolled, the more the sofa stayed perfectly still, steady as an upholstered rock. Again, all done for effect as much as anything.

Zaphod stepped through the wall of the globe and relaxed on the sofa. He spread his two arms lazily along the back and with the third brushed some dust off his knee. His heads looked about, smiling; he put his feet up. At any moment, he thought, he might scream.

Water boiled up beneath the bubble, it seethed and spouted. The bubble surged into the air, bobbing and rolling on the water spout. Up, up it climbed, throwing stilts of light at the cliff. Up it surged on the jet, the water falling from beneath it, crashing back into the sea hundreds of feet below.

Zaphod smiled, picturing himself.

A thoroughly ridiculous form of transport, but a thoroughly beautiful one.

At the top of the cliff the globe wavered for a moment, tipped on to a railed ramp, rolled down it to a small concave platform and riddled to a halt.

To tremendous applause Zaphod Beeblebrox

stepped out of the bubble, his orange sash blazing in the light.

The President of the Galaxy had arrived.

He waited for the applause to die down, then raised his hands in greeting.

"Hi," he said.

A government spider sidled up to him and attempted to press a copy of his prepared speech into his hands. Pages three to seven of the original version were at the moment floating soggily on the Damogran sea some five miles out from the bay. Pages one and two had been salvaged by a Damogran Frond Crested Eagle and had already become incorporated into an extraordinary new form of nest which the eagle had invented. It was constructed largely of papier m@ch@ and it was virtually impossible for a newly hatched baby eagle to break out of it. The Damogran Frond Crested Eagle had heard of the notion of survival of the species but wanted no truck with it.

Zaphod Beeblebrox would not be needing his set speech and he gently deflected the one being offered him by the spider.

"Hi," he said again.

Everyone beamed at him, or, at least, nearly everyone. He singled out Trillian from the crowd. Trillian was a gird that Zaphod had picked up recently whilst visiting a planet, just for fun, incognito. She was slim, darkish, humanoid, with long waves of black hair, a full mouth, an odd little nob of a nose and ridiculously brown eyes. With her red head scarf knotted in that particular way and her long flowing silky brown dress she looked vaguely Arabic. Not that anyone there had ever heard of an Arab of course. The Arabs had very recently ceased to exist, and even when they had existed they were five hundred thousand light years from Damogran. Trillian wasn't anybody in particular, or so Zaphod claimed. She just went around with him rather a lot and told him what she thought of him.

"Hi honey," he said to her.

She flashed him a quick tight smile and looked away. Then she looked back for a moment and smiled more warmly - but by this time he was looking at something else.

"Hi," he said to a small knot of creatures from the press who were standing nearby wishing that he would stop saying Hi and get on with the quotes. He grinned at them particularly because he knew that in a few moments he would be giving them one hell of a quote.

The next thing he said though was not a lot of use to them. One of the officials of the party had irritably decided that the President was clearly not in a mood to read the deliciously turned speech that had been written for him, and had flipped the switch on the remote control device in his pocket. Away in front of them a huge white dome that bulged against the sky cracked down in the middle, split, and slowly folded itself down into the ground. Everyone gasped although they had known perfectly well it was going to do that because they had built it that way.

Beneath it lay uncovered a huge starship, one hundred and fifty metres long, shaped like a sleek running shoe, perfectly white and mind-boggingly beautiful. At the heart of it, unseen, lay a small gold box which carried within it the most brain-wrenching device ever conceived, a device which made this starship unique in the history of the galaxy, a device after which the ship had been named - The Heart of Gold. "Wow", said Zaphod Beeblebrox to the Heart of Gold. There wasn't much else he could say.

He said it again because he knew it would annoy the press.

"Wow."

The crowd turned their faces back towards him expectantly. He winked at Trillian who raised her eyebrows and widened her eyes at him. She knew what he was about to say and thought him a terrible showoff.

"That is really amazing," he said. "That really is truly amazing. That is so amazingly amazing

I think I'd like to steal it."

A marvellous Presidential quote, absolutely true to form. The crowd laughed appreciatively, the newsmen gleefully punched buttons on their Sub-Etha News-Matics and the President grinned.

As he grinned his heart screamed unbearably and he fingered the small Paralyso-Matic bomb that nestled quietly in his pocket.

Finally he could bear it no more. He lifted his heads up to the sky, let out a wild whoop in major thirds, threw the bomb to the ground and ran forward through the sea of suddenly frozen smiles.

## 2 Section2

## A Appendix 1

### A.1 Appendix 2