

IMPACT OF RECTANGULAR PRODUCT SHAPES ON PURCHASE INTENTIONS

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Abstract. Studies conducted in the American context have shown the influence of rectangle's shape, determined by its side ratio, on preferences and purchase intentions. The premise of such study lies in the celebrated aesthetic value of the golden ratio. Given that the Indian culture is divergent from the American culture and perceptions of aesthetics could differ, the study was replicated in the Indian context. The first experiment, conducted in the context of advertisements for fast food outlets, determined the impact of rectangular ratio on relative preference and perception. In the second experiment, the impact of usage context on preference and purchase intention for rectangular invitations of varying ratios was studied. These studies showed a significant impact of the shape of rectangles on purchase intention, perception and relative preference. Additionally, it confirmed the moderating effect of context on the impact of ratios on purchase intention in the Indian context.

Key Words: Golden Ratio, Rectangles, Perception, Package Shapes

Package design has long been of interest to researchers since it is known to have an extrinsic impact on visual 'attention grabbing' (Pieters and Warlop, 1999) and perception of quality and quantity. A unique package for a product (shape, color and materials) gives marketers a definite advantage in the market place (Sherwood, 1999). It has been noted that brands often differentiate themselves by the shape of their packaging as it can affect a consumer's perception and purchase intent (Berkowitz, 2003).

The focus of research on packaging has been on both the package 'design' and 'shape'. While package 'design' has been examined in terms of its impact on consumer's quality perception (Pieters and Warlop, 1999; Ziehl, 1988; Murray and Delahunty, 2000), studies related to 'shape' have focused on its impact on consumer's perception of quantity. While some studies have shown that the "number of units purchased is contingent on the shape of a container, holding constant actual volume and price of the container" (Yang and Raghubir, 2005) other studies have shown that the shape of the packaging influences the perceptions of quantity (Folkes and Matta, 2004; Krider, Raghubir and Aradhana, 2001). Impact of the shape has been conceptualized, both in terms of its functional and emotional response. The response can be, however, different in different product categories (Sherwood, 1999). Studies focusing on managerial relevance of effective packaging strategy have shown that more than 60% of senior marketing managers consider design as the most important determinant of product performance (Bloch, 1995). In a study that examined the ways in which product appearance influenced consumers in terms of its ability to communicate aesthetic, symbolic, functional, ergonomic information, its ability to draw attention and categorize, Creusen and Schoormans (2005) found that packaging influenced the consumer choice by communicating the values associated with the product appearance.

Research that explains how consumers perceive shapes and designs can help product managers and designers to design appropriate packages for effective market placement and positioning. Although a number of studies have shown the connection between the product package designs, shape etc., with consumers' perceptions and buying behaviors in the USA, such research in the Indian consumer context is almost non-existent. The perceptual differences of aesthetics among various cultures are evidenced in several studies (Kak, 2004; Pittard, Ewing and Jevons, 2007; Masuda, Gonzalez, Kwan and Nisbett, 2008). Some of these are considered in providing a background for the cultural context in which this study has been replicated.

Background

The rectangle and its impact on perception: Literature in art, architecture, music, history and even biology has laid an emphasis on the mathematical beauty of certain shapes (Ghyka, 1977). The role of the golden ratio in art (The Vitruvian Man), architecture (the Pyramids of Giza and the Parthenon in Rome), music (scales of Indian Notes), and religion (The Christian Cross) etc., have been dealt with extensively in research (Thiyagarajan, 2006). Aestheticians have emphasized the mathematical beauty of certain shapes (Ghyka, 1977), while the mathematicians and physicians have focused on their aesthetic beauty (Kak, 2004).

Considering the fact that a large number of products and advertising layouts use the rectangular form, a study which examines consumer's preferences of rectangles in the context of rectangular products and advertising layouts becomes relevant.

Cultural issues in visual perception of shapes: While most issues related to visual perception seem generalizable, some aspects are vulnerable to impact of culture. Daniel Chandler (see web reference) narrates an experiment reported by Segall, Campbell and Herskovitz (1968) where they find that Müller Lyer illusion (an optical illusion of a straight line with inward turned arrows on the two sides, which makes people overestimate the point from the tail end to the mid-point) may be absent in some cultures described as 'circular cultures' (for example, those who live in circular hut constructions such as the African Zulu tribes) as against 'carpentered cultures' (for example, Americans who live in house which have angular and rectangular shaped rooms): "Europeans and Americans are more likely to interpret oblique and acute angles as displaced right angles and to perceive two-dimensional drawings in terms of depth". Another such experiment conducted by W. Hudson in 1960, showed that "formal schooling in the normal course is not the primary determinant in pictorial perception. Informal instructions in the home and habitual exposure to pictures play a much larger role" (see web reference). This may lead one to infer that at least part of visual perception is subject to learning, which is in turn moderated by the environment and culture in which an individual lives.

Perusal of literature in history, art and architecture will enable an inference that the preferences for certain ratios of rectangles may differ among different individuals, cultures and contexts. For instance, the golden ratio, 1.618 (Φ) is considered to be very pleasing in the western world and in Islamic art 1: $\sqrt{2}$ is an oft-used ratio (Kak, 2004). The golden mean, Φ , has been applied in diverse situations in art, architecture and music, and although some have claimed that it represents a basic aesthetic proportion, others have argued that it is only one of a large number of such ratios.

Masuda, Gonzalez, Kwan and Nisbett (2008) explored whether any variations were involved in the aesthetic perception of art and photography between East Asians and Americans. They found that the art of the East Asians was more contexts-driven than object-driven as in the case of American art. The researchers explain that the reasons for the maintenance of context vs. object in art, by members of these geographies could be found in cultural resources and aesthetic preferences.

From a three part experimental study done in North America, Raghubir and Greenleaf (2006) infer that people differ in the way they perceive rectangles of differing side-ratios. In a more recent study that dealt with preferences of rectangular ratios, Pittard, Ewing and Jevons (2007) examined reactions towards rectangular proportions across different continents (Australia, Singapore and South Africa). They found a universal preference for the golden ratio (1: 1.618) across cultures. While prior research, such as those discussed in the foregoing section, suggests that culture influences perception of aesthetic, research on the golden ratio suggests that some shapes may have universal appeal. Hence, a study which takes the golden ratio into consideration and is conducted in a different culture may have supplementary insights.

The research perspective

The three-part experimental study conducted in the American context by Raghbir and Greenleaf (2006) was designed to study the impact of the ratios of the sides of rectangles on the purchase intention of consumers for rectangular products. In the first study, the authors attempted to examine the influence of the rectangular ratios on the purchase intention, perception and relative preference of rectangular products. They used a square and two rectangles with differing ratios (1.38 and 1.62) with description of two concerts (A and B) to manipulate the ratio variable. Their study showed the significance of the rectangle's ratios in determining differences in purchase intention, preference and relative preference. Additionally, they also showed that the 'perception' had a mediating role in preference of rectangles. In the second part of the study, the authors extended the experimentation to a different product category and increased the number of ratios used for examination. In this study, they introduced the influence of 'Context' (usage situation) in moderating the purchase intention for certain rectangles.

Bloch (1995) proposed a conceptual model of factors that may affect consumer's reaction to product form. Further, Bloch (1995) pointed out that the gestalt qualities of the mathematically beautiful structures could be useful for managers who are involved with product design decisions. However, it is a conceptual model and only helps marketers and researchers by providing a framework for empirical research. This framework has been used to provide a reference point for incorporating some contextual features in this study.

Raghbir and Greenleaf (2006) used nine printed invitation cards of different ratios to manipulate the ratio variable and four different occasions to manipulate the context variable. The context in reference is a usage situation in terms of its relative seriousness. They concluded from this study that the ratio was significant in explaining variation in purchase intention in various contexts.

Given that culture can be a differentiating factor in the perception of shapes, this study attempts to determine the influence of rectangular ratios on purchase intention and perception, in the Indian subcontinent. Studies have pointed out the relevance of the golden ratio in the Indian culture. The significance of a rectangular ratio, being perceived similarly in the Indian culture as its western counterpart, provides a background to test findings of Raghbir and Greenleaf (2006). Given the cultural diversities between the eastern and western civilizations, especially in the matter of aesthetics, this study was done to test whether the results in culturally different contexts would yield similar results.

This study aims at examining the influence of ratios of the sides of a rectangular product/package/advertisement, on consumer purchase intention and preference in the Indian context. As this relationship may be moderated by the usage context of the product, this relationship between ratios and purchase intention was studied under a specific usage situation, namely, relative seriousness. Two extremes of the situation (relatively more serious and relatively less serious) have been considered to bring out the associated contrasting behavior.

STUDY 1. IMPACT OF RECTANGULAR RATIO ON PURCHASE INTENTION, RELATIVE PREFERENCE AND PERCEPTION

The aim of Study 1 was to empirically examine the relationship between ratio of rectangle's sides and purchase intention, perception and relative preference. This experiment was conducted to test whether the ratios of the sides of the rectangle influence the purchase intention and relative preference of the product which, in this study, was a fast food outlet. On an exploratory basis, the perception of ratios, the effect of ratio on relative preference and the impact of perception as a mediator of relative perception were also investigated. It was hypothesized that the ratio of the rectangle's sides affects consumers' (a) purchase intention and (b) preferences for rectangular products.

Methodology

173 first year post graduate students of marketing and finance were chosen as subjects in the study. Two advertisement copies of invitation to the inauguration of fictitious fast food outlets A ('Cool Joint') and B ('Chill Out') were developed. A questionnaire tapping the preference measures included the invitation to the inauguration of two of the fictitious new fast food outlets. The 'copy' for "Cool Joint" was in a square shaped invitation while that of "Chill Out" was in two rectangular (1.38 and 1.62) shaped invitation. The square shape was employed as a control shape to enable comparison. The Φ (1.62) ratio was included as literature indicates its aesthetic qualities (Pittard, Ewing and Jevons, 2007).

The subjects were exposed to invitations of both the fast food outlets. However, the subjects were randomly assigned to one of the two groups which had rectangular "Chill Out" invitations of two different side ratios. While one group was exposed to "Chill Out" invitations which had a rectangular side ratio of 1.38, the others saw invitations to "Chill Out" that had a ratio of 1.62. The two outlet descriptions were intended as the stimuli in the experiment. The subjects were told that the study aimed to test their relative preferences of fast food outlets "Cool Joint" and "Chill Out". The respondents were asked to assume that two new fast food outlets would be located equal distances from their institute of education and they had been mailed two invitations for free trial offers for an evening. The respondents were told that they could choose to accept the invitation of only one of the outlets and therefore indicate their responses to 'likelihood of visit' accordingly.

The two groups answered the same questionnaire and viewed the same advertisement copies. The only variation made between the two groups was to the variable of interest i.e., the ratio of the sides of the rectangle. 160 valid questionnaires were obtained for analysis of data from the experiment.

Measurement of Variables

The purchase intention was recorded on a seven-point 'likelihood of purchase' scale. The relative preference data was collected from a six-point 'relative preference' scale with higher numbers indicating preference for outlet B. Perception was measured on a seven-point scale of six items, the two descriptions (Fast food outlet A and B) were compared to obtain an exploratory idea on the perception measure. The scale was tested for reliability and a factor analysis was used to confirm whether the responses were as expected.

Gender and frequency of visits were used as control variables since they can impact perception of aesthetics. Using "frequency of visit" measure as the covariate, and the two categorical variables, 'gender' and 'ratios' as the two independent variables, the data were analyzed using repeated measures ANCOVA (SPSS v.13). Purchase intention was first studied, followed by perception and relative preference. The mediating role of perception on relative preference was also studied on an exploratory basis.

Data Analysis and Results

Purchase Intentions: The two rectangular ratios and gender were used as independent variables, while covariate was "frequency of visit". The mean purchase intention when the ratio was 1.62 (Mean = 4.31) was greater than the mean purchase intention when the ratio was 1.38 (Mean = 3.06). As expected, the 1.62 ratio generated larger purchase intent than the 1.38 ratio. Ratio was the significant differentiator ($p < .01$). 'Gender' and 'frequency of visit' were not significant. Thus, the results support the hypothesis that there is a significant impact of rectangular ratios on purchase intentions.

Perception: Perception is considered an underlying factor for various behaviors that consumers exhibit and the perception of products (Howard and Sheth, 1969). Literature indicates that preferred rectangles promote the perception of harmony, proportion, balance, rationality and mathematical beauty. A perceptual measure, called an index of "Harmony" incorporating these items was used to measure relative perception of "Chill Out" vs. "Cool Joint" (Raghubir and Greenleaf, 2006).

The six items (pleasant, beautiful, comfortable, serene, exciting, fast) loaded on two factors, with exciting and fast loading on one factor and the other three items on the other factor. The harmony index ($\alpha = 0.79$) was created after averaging the scores of the scale. Higher values indicate perception of greater harmony for "Chill Out" (Harmony = 4.357). The scale has been slightly modified from Raghubir and Greenleaf (2006) as per the subject matter of the study.

Relationship between perception and ratio: An ANCOVA was performed using the perceptual scale as the dependent variable. The independent variables were gender and the two ratios (categorical variables). The 'frequency of visit' measure was used as a covariate. The mean for perception ratings when the ratio was 1.62 ($M = 4.65$) was more than the mean for perception rating when the ratio was 1.38 ($M = 4.045$); the ratio was significant in explaining differences between the groups ($sign < .01$). The gender (was significant at 10%: $p = .056$) and 'frequency of visit' were not significant in explaining differences in the groups. This provides initial evidence that ratio can influence product perception, at least for the dimensions mentioned in literature and adapted to the scale.

Relative Preferences: An ANCOVA was used to analyze the impact of ratio on relative preference. The gender and ratios were used as independent variables and the frequency of visit was used as covariate. The perception measure and purchase intention were also added as a covariate to see whether they have an impact on the relative preference. The relative preference when the ratio was 1.62 ($M = 3.94$) was greater than when the ratio was 1.38 ($M = 2.67$); the ratio was found useful in explaining difference in the two groups' relative preferences ($sign < .05$). Perception measure was significant ($sign < .01$) and purchase intention was also relevant ($sign < 0.05$), indicating that perception and purchase intention have a mediating role in the impact of ratio on relative preference of fast food outlet.

Summary: The results of Study 1 indicate that the ratios of the sides of the rectangle impact purchase intentions and to some extent the relative preferences. On an exploratory basis, it was shown that ratio can affect product perception and this perception (related to aesthetics mentioned in literature) can influence relative preference of products. The moderate significance of the gender covariate may indicate that this variable may have a role to play in perception of shapes.

STUDY 2. PURCHASE INTENTION FOR INVITATION CARDS

The second study extends the first study by examining the impact of rectangle's side ratios on purchase intentions in a different product category. The number of ratios considered in this study was increased from two rectangular ratios to six ratios. Additionally, this study examines the 'context' of usage of the product as a moderating variable. Lilien, Kotler and Moorthy (1992), suggest that the consumers differ in decision making because of differences in individual personality, values and preferences; different choice processes and different context of purchases can be because of usage situation or purchase situation. Given that this experiment focused on individual choice making, it is reasonable to use the 'context' as a factor in the study.

The hypothesis for this study was similar to that of study 1 in that it examined the impact of the ratios of the sides of the rectangle on purchase intentions of products and additionally it also examined the moderating role of usage 'context'.

Methodology

Bloch's (1995) conceptual model on consumers' reactions to product form proposed a theory on how 'context' (situational factors, cultural and social factors etc..) can affect consumers behavior with reference to product form. In this study 'context' is used in the sense of 'usage situation'. An attempt is made to simulate/evoke a consumer reaction in a product purchase situation.

The product chosen to simulate the purchase reaction was 'printed invitation cards' for four specific occasions and four occasions were chosen to represent 'relatively more serious' and 'relatively less serious' situations to manipulate the 'context' variable. The occasions chosen were a classical music concert, business presentation for sale of accounting software application, 3-yr old child's birthday party and going to a comedy movie with friends.

A sample of 150 MBA students (130 valid questionnaires obtained) were asked to assume that they were in a printers' shop to order for printed invitations for the four occasions and for this purpose, the printer had asked them to make the following choices for each occasion:

1. choice of a blank card (out of six blank cards- (1:1; 1:1.18; 1:1.44; 1:1.63; 1:1.77; 1:2)
2. choice of a color (out of 4) for the envelope and
3. choice of a font (out of 5)

The rectangular cards were labeled (A – F) on the bottom right hand corner and displayed in front of the group. Half the participants were exposed to horizontal orientations and the other half were exposed to a vertical orientation of the blank cards as studies in perception have shown a difference in such perception. The respondents answered the questionnaire by looking at the cards and making their choices.

Measurement of Variables

Measuring purchase intent: The respondents were asked to indicate their likelihood of choice on a scale of 1-6 with 6 being most likely choice and 1 being least likely choices for each ratio for each occasion. The respondents were also asked to indicate their most likely and least likely choices for each of the four occasions. Both ranking and rating data were thus collected from the respondents to measure purchase intention.

Measuring relative seriousness of occasion: After rating the purchase intentions, the respondents were asked to rate each of the occasions on a 5-item 7-point semantic differential

scale (frivolous/serious; orderly/disorderly; cohesive/straying or meandering, unpredictable/stale; rational/emotional) to check whether the respondents actually perceived the occasions as intended: relatively more serious vs. relatively less serious. The purpose of the measure was not to check the reliability of the scales for measuring relative seriousness, but only to assess whether the respondents had perceived the occasions as intended. Reliability test and factor analysis was done to confirm this proposition.

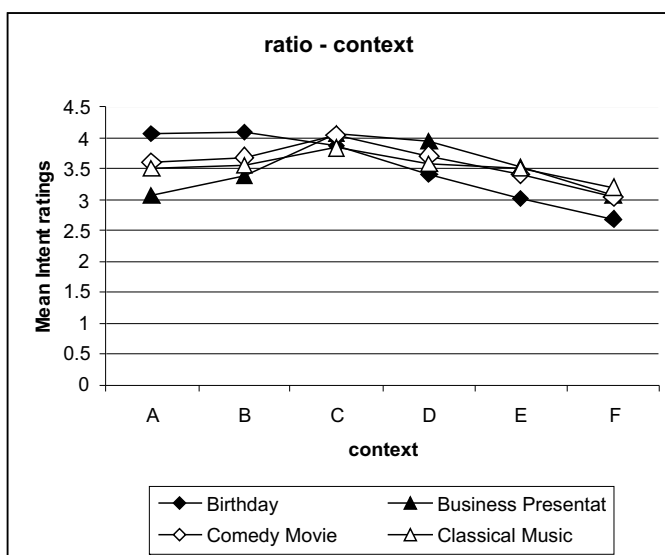
Data Analysis and Result

Manipulation Check: A factor analysis (principle component analysis with varimax rotation) was done using SPSS v.13. The items of the scale loaded on one factor for the occasions intended to be more serious and the items loaded on two factors for the occasions intended to be less serious. The five items were averaged to obtain a measure of relative seriousness ($\alpha = .739, .674, .475, .466$ for business presentation, music concert, birthday party and comedy movie).

A 2×2 repeated measures ANOVA on this measure showed that participants rated the occasions as intended (M:-More Serious: Business Presentation = 1.883, Classical Music Concert = 2.880; Less Serious: Birthday Party = 4.81, Comedy Movie = 5.023); Main Effect of Context ($p < 0.01$; Main Effect of Replicate ($p < 0.01$); interaction effect: ($p < 0.01$)

Purchase Intention: To test the hypothesis that the ratio of the rectangle's side impacted the purchase intention, the purchase intention ratings were analyzed using $6 \times 2 \times 2$ within subjects repeated measures ANOVA. The results showed that the purchase intentions differed by the ratio (sign. $< .01$). The ranking data were analyzed using non-parametric chi-square test. This showed that the number of participants who chose a ratio as their first choice was impacted by the ratio of the cards [$\chi^2(5) = 54.431; 13.262; 17.6; 19.446$ for Birthday party, Comedy Movie, Business Presentation, Classical Music Concert]. Similar results were obtained with the least likely to buy ranking [$\chi^2(5) = 111.108; 106.585; 125.969; 90.154$ for Birthday party, Comedy Movie, Business Presentation, Classical Music Concert]. Both the ranking data and rating data, therefore support the hypothesis that the ratio of the sides of the rectangle (invitations) impacted the purchase intention. The mean purchase intention scores for each occasion for the various ratios are given in figure 1.

Figure 1: Mean purchase intention scores across ratios



Impact of context on purchase intention: To examine whether the purchase intention of different ratios was influenced by the context, the ANOVA results were used. The results showed that the impact of the context in purchase intention was significant [Ratio \times Context Interaction: sign. < 0.01] and there was also a significant three way interaction [ratio \times context \times replicate: sign. < 0.01]. The overall effect of context was insignificant and so was the interaction effect of context and replicate. Thus second hypothesis for study 2 that the context influences purchase intention of the rectangular shaped product is also supported. However the ranking data on this did not support the effect of context on purchase intention of ratios; for most likely ranking: [$\chi^2 (25) = 30$, not significant] and least likely ranking: [$\chi^2 (25) = 30$, not significant]. While the ANOVA shows a difference among means, the ranking data does not indicate specific differences among the occasions. This may be an artifact of the experiment objects used. It is possible that the respondents were confused with the number of ratios presented. While they had clear purchase intentions, they could have been confused when ranking the various rectangles.

Summary: This study provides additional proof for the effect of ratios on purchase intentions and also proves that the context of usage of the product can have a moderating influence on the purchase intention of different ratios.

DISCUSSION

This study has shown, in congruence with Raghurir and Greenleaf (2006), that the ratio of the sides of the rectangle has an impact on the purchase intention. While previous studies on rectangles and rectangle perceptions have assumed rectangles to be an abstract image (Folkes and Matta, 2004; Krider, Raghurir and Krishna, 2001; Raghurir and Greenleaf, 2006), this study examines the perception, purchase intention and preference of rectangle in a product situation. The result of this study shows that the ratios of the sides of the rectangle have a significant impact on consumer behavior. This study has shown similar results and agrees with the results of the study done in the North American Context (Raghurir and Greenleaf, 2006).

While Raghurir and Greenleaf (2006) used a serious occasion such as a musical concert for the first study, this study uses a less serious product such as an informal fast food outlet. Despite this difference, the results have remained the similar. The minor differences in the results of the study are only in terms of perception of the four occasions. Although the occasions have been similarly conceived in terms of the contexts, the factor loadings show dissimilar trends in the perception of the occasions and the scale was also less reliable for less serious contexts. The main effect of context was also non-significant as against an expected significant overall effect as in the study done in America. The chi-square test, done to compare the ranking data when both occasion and ratios are taken into consideration was not significant. This result is in contrast with the Raghurir and Greenleaf study. Except for these differences which have not impacted the overall results of the study and proof of the hypotheses, the study has provided additional proof for the impact of ratios on consumer behavior by extending it to a different cultural setting.

While this study only tests the behavior of consumers in an experimental setting, the study could be extended and made more meaningful by examining market place response to the ratio variable. The study also takes into consideration only a single context: relative seriousness. This area of research can become richer if similar inferences could be made in other contexts (personal use vs. gifting purpose, utilitarian vs. hedonic purpose etc.,) and also by studying effects of multiple contexts. It is recognized that issues such as color, copy, placement and size can impact the manner in which the rectangles are perceived and information is processed. Hence these variables can also be used as a context to examine the impact of the rectangles.

It is interesting to note that the preference for golden ratio remains despite cultural differences as shown in other studies (Pittard, Ewing and Jevons, 2007). The cultural differences may however influence the perception of context or occasion of use itself. Hence the choice of certain shapes may change due to the perception of the occasion where the shape will be deployed. A study of consumer's perception of occasions across culture and their subsequent choice or preference of shapes would be relevant and useful in an increasingly global market.

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APPENDIX 1

Stimulus used in Study 1 (Not presented in proportion used in the study)

Outlet A

“Cool-Joint”
“The best place to leave a bit of your present behind”

The cool and perfect place
to spend those free hours, when there seems to be
nowhere to go and nothing to do...but listen to the juke box

Get out of the temperamental ‘blow hot blow cold’ weather
and make yourself comfortable at “Cool-Joint”

Make your Celebrations memorable
with the perfect ambience at “Cool Joint” with the soft instrument music of
violins

Be your complete-self when its time to let go and party.

We invite you, this Saturday, for a fun and excitement filled experience at the
opening of “Cool-Joint” – your local Fast Food Outlet/Café – totally free of
cost.

.....And don’t forget to bring company!

Outlet B

“Chill Out”
“A picture perfect place to stick into your memory album”

The perfect, chilled out place
for you and your friends to simply ...hang out...with music of your choice.

When the outside gets too hot to handle, let yourself into the comfortable and secure hang-out at
“Chill Out”.

When its time to celebrate, defreeze the occasion at “Chill-Out”

When it is time to let your hair down, do it with the beats of the drums, strings of the guitar and
all the excitement that you can muster at
“Chill Out”

We invite you, this Saturday, for a fun and excitement filled experience at the opening of “Chill
Out” – your local Fast Food Outlet/Café
– totally free of cost.

.....And don’t forget to bring a friend or two!