

# Re-design of Dongfeng 350 Tractor by System Design Theory

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**Abstract:** *Tractors are the most convenient means of transport for modern farm tools. In order to adapt to our country's rural production system and to facilitate the rural short-distance transport, Changzhou Dongfeng Agricultural Machinery Group Co., Ltd. has developed a small wheeled tractor; Dongfeng 350 tractor. This topic is based on Dongfeng 350 tractors this specific to model design. The main purpose is to solve the common problems of domestic tractors: a single shape and color. It is incompatible with the man-machine relationship between the daily work of the operator and the popular aesthetic product modeling. According to the above problems, the design of Dongfeng 350 tractor is re-designed by using system design theory.*

**Keywords:** appearance design; interaction design; structural analysis; color design; tractor

## 1. Introduction

A tractor is an engineering vehicle specifically designed to deliver at a high tractive effort (or torque) at slow speeds. Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage, but nowadays a great variety of tasks. Agricultural implements may be towed behind or mounted on the tractor, and the tractor may also provide a source of power if the implement is mechanized.

The tractor is used to pull and drive the operating machinery to complete each mobile operating vehicle and also can do the fixed operation power. It is composed of an engine, transmission, wheels, steering, hydraulic suspension, power output, electrical instrument, driving control and traction, etc. The power of the engine is transmitted from the transmission system to the driving wheel to drive the tractor. In real life, rubber belts are often used as the medium for power transmission. Tractors are used in agricultural, industrial and special purposes for different function and purpose.

The DONGFENG 350 is a newly developed product series of Dongfeng Agricultural Machinery Group Corp. (Changzhou Tractor Plant). It is powered with the three-cylinder diesel engines that have the features of ample output, less vibration, and low noise as well. Model DF-350 tractors are of the dual-function type for using in both paddy and dry fields.

## 2. Research Theory and Method

System design is the process of defining system architecture, modules, interfaces and data to meet specified requirements. System design can be regarded as the application of system theory in product development. It overlaps with the disciplines of system analysis, system architecture and system engineering. If the theme of product development is broader and the perspectives of marketing, design and manufacturing are integrated into a single method of product development, then the design is a kind of behavior that can obtain marketing information and create products to be manufactured. Therefore, system design is the process of defining and developing systems to meet the specific needs of users. In the

process of product design, we need to grasp the basic law of system theory: structure-function correlation law and information feedback law. The structure is the basis of product function and structure, but the function can also respond to structure. A stable structure is a prerequisite for effective operation. Therefore, structure and function are two basic attributes of the system.

Systems design could be seen as the application of systems theory to product development. It has some overlap with the disciplines of systems analysis, systems architecture and systems engineering. If the broader topic of product development blends the perspective of marketing, design, and manufacturing into a single approach to product development, then the design is the act of taking the marketing information and creating the design of the product to be manufactured. Systems design is therefore the process of defining and developing systems to satisfy specified requirements of the user.

In the process of product design, we need to grasp the basic law of system theory: the law of structure-function correlation and the law of information feedback. The structure is the basis of product function and structure, but the function can also react to structure. A stable structure is the premise of effective functioning. Therefore, structure and function are two basic attributes of the system.

## 3. Scheme Design

### 3.1 Phase I sketch design

Early design mainly adopts the divergent thinking in the form of "brainstorm" from many Angle to think about the appearance of the tractor model, this stage try to eliminate the effects of specific models give full play to the subjective initiative, to produce many creative preliminary schemes (fig:3-1).

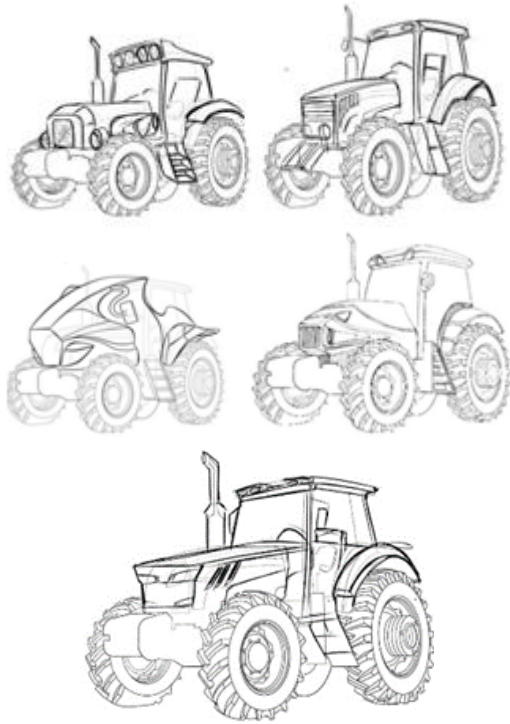


Figure 3-1: Phase 1 preliminary design

### 3.2 Phase 2 sketch design

After the end of brainstorming, we began to think rationally about all the factors that influence the appearance of the tractor, and remove the concept of the too expensive cost that is hard to achieve, leaving a plan that we can continue to deepen. In the design of the head, the roof of the specific design, improve the details of the plan. (fig:4-6 to fig:4-10)

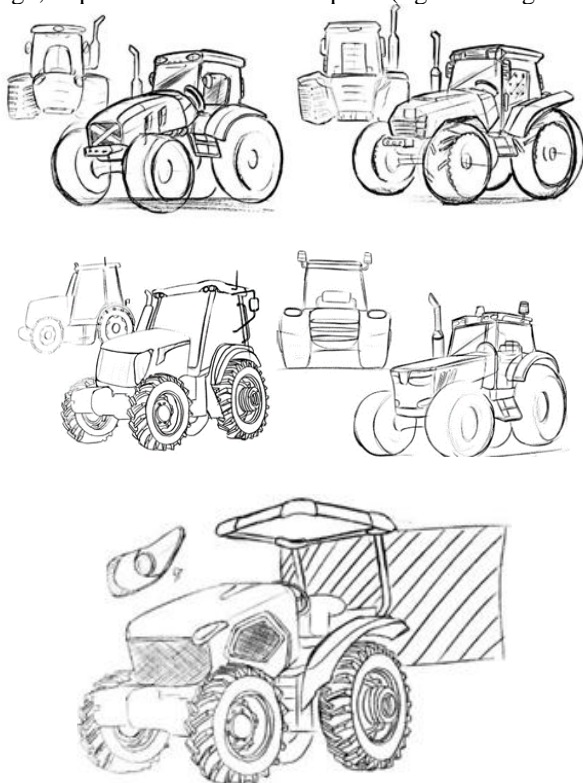


Figure 3-2: Phase 2 sketch design

### 3.3 Phase 3 sketch design

The final plan to focus on the front and on the roof shape of the tractor, design is different from the above scheme as global thinking possible, to further improve the combination of advantages of each scheme, including the expected cost estimate, product market positioning, processing difficulty, the whole structure of rationality. Therefore, in this stage, the following plan is selected to further deepen the design and verify the feasibility and scientificity of the design and the rationality of the structure. (Fig:3-11).



Figure 3-3: Phase 3 design

### 3.4 Determination of the final sketch

After analyzing and discussing, considering various factors, including the beauty of modeling, cost budget, material and technology, and market positioning, the final plan is selected. The final scheme adopts the most suitable scheme, which uses large area glass panel to improve observation space while sealing the cockpit to ensure the driver's comfortable driving environment. (figure 3-4).



Figure 3-4: Final sketch

## 4. Product Structure Design

### 4.1 Phase 3 sketch design

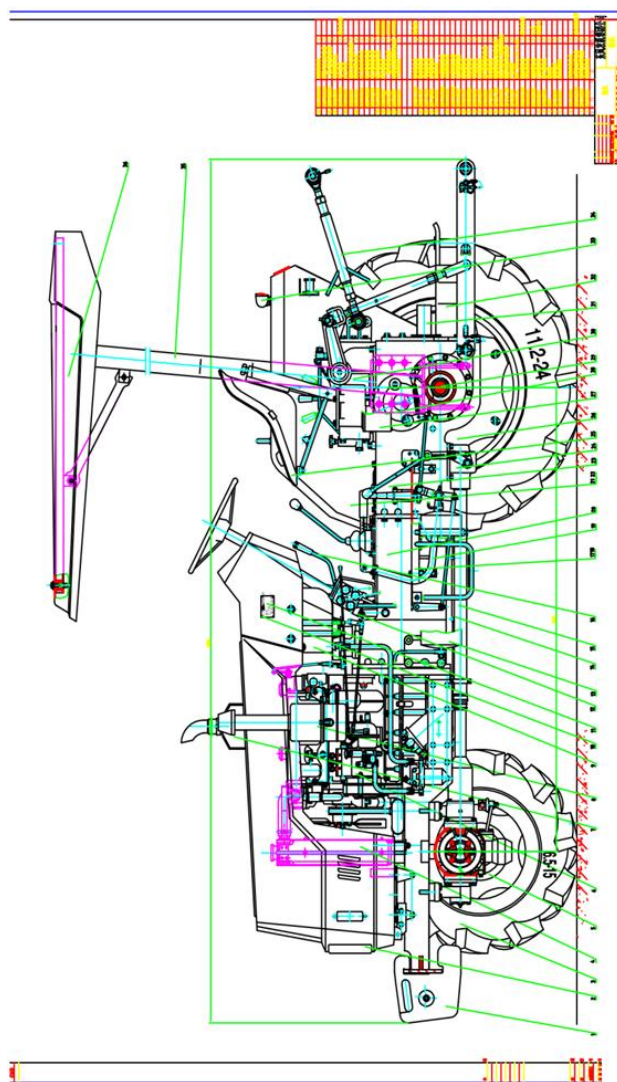


Figure 4-1: Internal tractor structure

Counterweight assembly before 1. 2. The hood instrument cover assembly (3) the front-wheel drive assembly 4. 5. Radiator parts front axle assembly 6. 7. Diesel engine exhaust pipe assembly 8. 9. Air filter assembly fuel tank assembly 10. 11. Screw products sign 12. 13. Hydraulic steering system assembly superposed trailer air brake device assembly 14. Oil filter, oil pipe assembly 15. 16. The shaft assembly throttle operator assembly 17. Left the floor assembly 18. The right floor assembly 19. Clutch assembly, transmission assembly, 21, 22 left fender assembly. 23 right fender assembly. The rear axle assembly 24. The transfer case assembly. 25 26 driver assembly. 27. The driving wheel assembly kit assembly 28 and operating mechanism of brake assembly 29 30. The final drive assembly lifter assembly 31. 32. The power output shaft assembly traction device assembly 33. Electrical assembly 34 suspension assembly

### 4.2 Appearance three views

Shown as in Fig:4-2

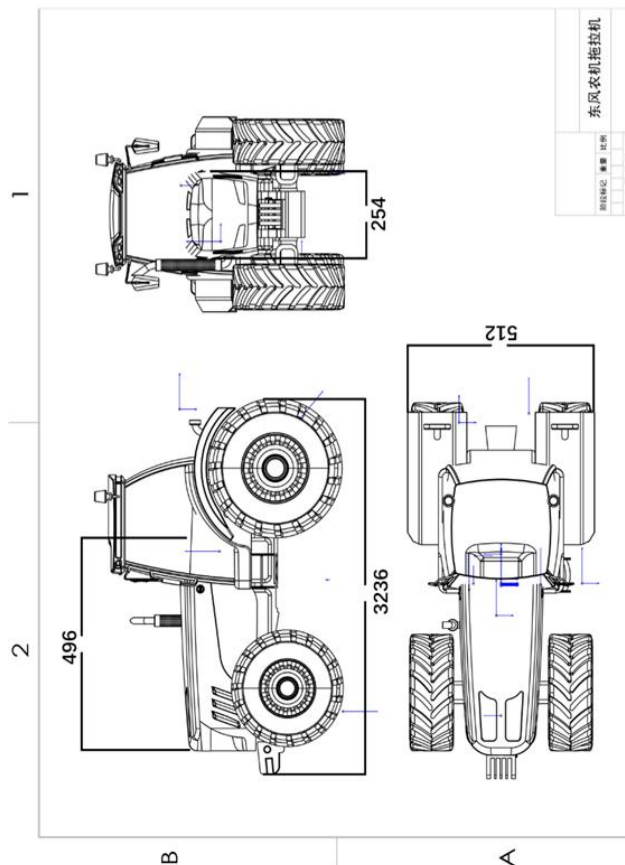


Figure 4-2: 3-side views

### 4.3 Product explosion figure



Figure 4-3: Explosion view

### 4.4 Tractor operating area design

The tractor is a self-propelled power machine used for traction and driving operation machinery to complete the various mobile operation. Also, can do the fixed operation power. It is composed of an engine, transmission, walking, steering, hydraulic suspension, power output, electrical instrument, driving control and traction, etc. In real life, rubber belts are often used as the medium for power transmission. Tractors for agricultural, industrial and special purposes by function and purpose; According to the structure type, type, crawler, boat tractor and self-propelled chassis, etc.



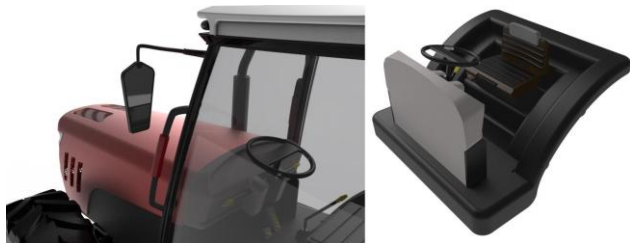


Figure 4-5: Tractor Operation Cabin

In the position setting of the operation table, considering the convenience of operation, it is placed in the front end of the chair, so that the operator can have a broader view and can better observe the progress of the construction area.

## 5. Logo sketch design The final result

### 5.1 Logo sketch design

The product logo USES better visual effects and information recognition images and words and displays the design process of product function and target enterprise image. Because the (fig:8-1)



Figure 5-1: Dongfeng tractor logo

In the course of the use of the tractor, it should also have the corresponding product marks to indicate the brand value of the product. This topic reserves the regular sign position, one is to improve the brand popularity; second, to retain the historical features of the product.



Figure 5-2: logo color



Figure 5-3: mark size

### 5.2 Color conceptual design

The following main color schemes are designed according to the product positioning requirements:


Scheme 1 (fig: 8-4) color selection: Color color-coded label: . Color scheme is mainly through black and red, mainly red, with black, forming a sense of motion. This kind of color collocation is used widely and very practical in the transportation tool, mainly in order to highlight the vitality of the product.



Figure 5-4: Scheme 1


Scheme 2 (fig:8-5) color selection: Color color standard: . Color scheme mainly through black and blue, mainly blue, with black, forming a sense of future. This color combination is widely used in transportation and is very practical, mainly to highlight the technical sense of the product.



Figure 5-5: Scheme 2

## 6. Conclusion

Despite the negative influence of late Qing Dynasty, immature Republic of China, and the unforgettable Cultural Revolution, the Chinese economy was just a momentary split and a short-pause as compared with the brilliant achievements of the Western modern industry for 300 years and the Chinese nation for thousands of years. The great achievements of the reform and opening-up over the past 30 years have proved that after the rapid recovery and revitalization, every stage can be regarded as the necessary experience and lessons for later generation development.

In a short period of thirty-two years, the aesthetic thought of Chinese industrial design has steadily melted into the essence of Chinese culture and strived to cooperate with the rapid development of modern industry. The perfect thought-combination of the Taoism's "harmony between man and nature", the Confucianism's "the golden mean" and the Buddhism's "Karma and reincarnation" is an excellent way to solve the ecological and human problems of today's world. There are lots of reasons to believe that the 21st century is a glorious era of Chinese industrial design aesthetics.

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